PEACE RIVER SITE C - STUDY AGREEMENT

EXECUTIVE COMMITTEE REPORT

VOLUME I

January 1987

SITE C STUDY AGREEMENT

EXECUTIVE COMMITTEE REPORT

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SITE C STUDY AGREEMENT

EXECUTIVE COMMITTEE REPORT

1.0 SUMMARY

The Executive Committee has concluded that the Site C project is a feasible source of power to support a B.C. Hydro sale to the United States for the 20 - 30 year period following 1994.

The studies indicate that:

- the project can be designed, constructed and the power delivered to the US/Canada border within the estimated costs and the time schedule presented;
- a market exists in the Pacific Northwest and California for the quantity of firm power to be generated at Site C;
- the power will be more valuable and marketable if the sale is supported by the B.C. Hydro system;
- up to a $15 million investment in transmission facilities in addition to those currently planned is required in the United States for delivery of the power to the Pacific North West and California.
- Bonneville Power Administration (BPA) will need to complete an environmental review process which will include the preparation of an Environmental Impact Statement (EIS).

However in reaching these conclusions, many assumption have had to be made with regard to contractual terms, regulatory approvals and delivery of the power within the United States. The conclusions and assumptions are discussed herein.

Finally, the Executive Committee wishes to emphasize that the realization of the Project by the mid 1990's will require the continuing active support and approval of the Government of British Columbia, and the willingness on the part of BPA to furnish transmission for Site C power from the Canadian/U.S. intertie, or alternatively the willingness of others to provide transmission from Canada to the California/Oregon border.

2.0 INTRODUCTION

This report is presented in accordance with the Agreement dated 12 June 1986 between British Columbia Hydro and Power Authority, Bonneville Power Administration and the several utilities in the Pacific

Northwest and California (the "Signatories") wherein B.C. Hydro indicated their willingness to construct the Peace Site C Project and dedicate the power generated therefrom, in excess of domestic requirements, to the United States under long term contracts having economic benefit to British Columbia.

As required by the Agreement the studies were undertaken to identify, examine and assess the technical elements, legal issues and economic factors relevant to the generation, transmission and marketing of the power from the Project.

These studies were carried out under the direction of an Executive Committee by a Technical Working Group and a Legal Working Group comprised of representatives of each of the Signatories. The Working Groups met as required to carry out the terms of reference outlined in the Agreement and each submitted reports to the Executive Committee which are included as Appendices to this report.

The Executive Committee met monthly to review the progress and direct the activities of the Working Groups. This report incorporates the findings and conclusions of the working groups, assesses from several aspects the feasibility of the Project as a source of power for export to the United States, and identifies other matters requiring further consideration.

3.0 CONCLUSIONS

3.1 CONCLUSION NO. 1

Site C is a technically feasible generation project. The construction of Site C and additional transmission facilities within British Columbia would permit the delivery of 805 MW of capacity and 4220 GWh/a (482 average megawatts) of energy to the Canadian border on a long-term basis. The direct construction costs of the dam and generating station are estimated at $1.4 billion (October, 1985 Canadian dollars) and the direct construction costs of additional B.C. Hydro transmission facilities are estimated at $250 million (October, 1985 Canadian dollars). Site C could be constructed within approximately seven years after necessary financial and contractual arrangements and regulatory approvals are in place.

Assumptions:

- Construction financing would be available on acceptable terms.
- The results of additional required environmental and technical studies would not materially increase the estimated construction costs nor significantly delay the Project.
- Provincial and Canadian regulatory approvals could be obtained on an expedited basis.

Discussion:

If long-term contracts can be executed with major U.S. utilities in the PNW and California for the sale of an amount of firm power roughly equal to the output of Site C, there is no reason to believe that construction financing would not be available on reasonable terms. The Executive Committee did not attempt to identify financing arrangements and therefore expresses no opinion with regard to the availability of financing. It was felt by the Executive Committee that this issue should await the establishment of definitive terms for marketing of the power.

The environmental studies previously undertaken by B.C. Hydro, and reviewed by the British Columbia Utilities Commission (BCUC), found no adverse environmental consequences arising from the construction of Site C or the associated Canadian transmission improvements.

The additional Canadian environmental and technical studies that have to be undertaken prior to construction are not believed to be either substantial in scope or likely to increase materially the construction cost estimates.

B.C. Hydro has advised that the current policies of the Governments of Canada and B.C. will permit long-term export of firm power on compliance with regulatory procedures. British Columbia will require that the contracts for the sale of such power be of benefit to B.C. However, the Executive Committee recognizes that governmental policies are always subject to change.

3.2 CONCLUSION NO. 2

A market exists in the United States for the quantity of firm power associated with Site C during the 20 - 30 year period following 1994.

Assumptions:

- The price at which B.C. Hydro offers the power will be competitive, meaning that the delivered price of the power must be at least economically equivalent to each utility's most attractive alternative 20 - 30 year resource/supply options for the mid-1990 period.
- The National Energy Board Act (Canada) will continue to permit long-term firm export for terms up to 25 years and will accept the competitive price defined above.
- Risks associated with project cost or operating cost increases, including water fees, currency exchange rates and other costs which are not controllable, are allocated to the satisfaction of all Parties.
- State regulatory commissions do not oppose or preclude utility participation in the project. The California Public Utilities Commission (PUC) does not allow PURPA-qualified facilities (QF) resources to displace the need for the project's power.
- Purchasers are either adequately protected from supply risks (e.g. by Treaty or contract provisions) or are willing to accept those risks.
- wheeling costs and line losses within the U.S. do not make the project power uncompetitive.

Discussion

The size of the potential market among the U.S. signatories for competitive, long-term firm power during the 2-3 decades following Site C's earliest practicable in-service date is up to 3102 MWa, or over six times the Project's energy producing capability. Perhaps the most critical assumption underlying this market size figure is that the delivered price of power associated with Site C will compete with the purchaser's most attractive alternative during the mid-1990 period. No attempt was made by the Technical Working Group to identify such a price or to perform any economic analysis of each Signatory's resource alternatives which would suggest what actual percentage of the "potential" market is likely to find Site C competitive.

Study participants contemplating a long-term purchase consistently stated an interest in the purchase being a viable replacement to the construction/acquisition of a long-term resource. At present, Canadian law restricts export sales to 25 years. This duration should be acceptable for most potential purchasers, however a longer term would improve the marketability of the product.

In addition to the issues of project economics and duration of commitment, potential purchasers will recognize that a number of major risks must be either managed or accepted. Some of these major risks are associated with the project's potential cost volatility, regulatory requirements and the possibility of supply disruption. These risks are highlighted because they depend on factors largely outside of the control or influence of the Parties. Each of these risks is perceived as being significant enough to jeopardize each purchaser's willingness to acquire Site C power, and represent areas in which further work related to identifying, managing or allocating these risks is needed.

Further, it will be acknowledged that power from the project which may be cost-competitive as delivered at the U.S.-Canada border may not be cost-competitive when delivered to a load centre if wheeling costs and losses are excessive.

In the end analysis, U.S. utilities will base their decision to purchase long-term power on the price offered by B.C. Hydro relative to alternative opportunities, and on the perceived risks accepted in such a purchase. B.C. Hydro, by the same token, has clearly stated its intention to price Site C related power at or above the full cost of constructing and operating the Site C project. Therefore, B.C. Hydro will only be able to provide an attractive and competitive offer if the fully allocated cost of Site C is lower than other new projects or contracts available to U.S. utilities.

3.3 CONCLUSION NO. 3

Site C power will be more valuable and marketable if the actual power output is supported by the entire B.C. Hydro system.

Assumptions:

- B.C. Hydro can shape project output into daily on-peak hours.
- B.C. Hydro can shape project output during high run-off spring months when PNW and California utilities would not be able to take maximum advantage of the Site C power, into other, higher value periods.
- B.C. Hydro can provide the contracted amount of energy, capacity and shaping on a firm basis.
- The benefits provided to purchasing utilities as a result of the shaping and firming services described above will be at least equal to the costs incurred in providing these services.

Discussion:

Almost every potential purchaser prefers to receive power in a daily and seasonal shape different from the expected production capability of the Site C project. In order to shape the output into on-peak daily hours and out of spring months, the capabilities of the B.C. Hydro system will be required. In addition, most potential purchasers place substantially greater value on a purchase of system-supported power as opposed to dependence on the project output of a yet unbuilt plant thousands of miles from their load centres.

These services require B.C. Hydro to employ the shaping and firming capabilities of their system to back up and add value to the Site C project power. It is important to note that B.C Hydro may incur costs in providing these system services. The price charged by B.C. Hydro for these services must be economical compared with the value which is added in the eyes of U.S. customers. In the event these services cannot be provided at an economically attractive price, the Site C project may still be attractive if the purchasers can provide these shaping and firming services themselves at an acceptable cost, or purchase them from another utility. Further study into these matters can be undertaken once the requirements of the purchasers are more precisely defined.

3.4 CONCLUSION NO. 4

Power in the quantities studied could be delivered from the Canadian-U.S. border throughout the Pacific Northwest and California, after the expenditure of up to $15 million (U.S.) for transmission improvements in the Northwest in addition to currently planned facilities.

Assumptions:

- BPA wheels all the power to purchasers in the Northwest and California on its existing (reinforced) system, following satisfactory environmental review under National Environmental Policy Act (NEPA).
- BPA's Long-Term Intertie Access Policy permits firm wheeling of B.C. Hydro power to California on terms acceptable to BPA, B.C. Hydro and the California utilities.
- BPA provides firm transmission service to Northwest utilities for B.C. Hydro power on acceptable terms.
- Acceptable financing is available for transmission improvements.

Discussion:

As the report of the Technical Work Group notes, sufficient reliable transmission capacity is available in the Northwest and California to deliver power associated with Peace Site C with only modest reinforcements in the Northwest. Unless additional transmission from the Canadian-U.S. border is built by someone other than BPA, transmission of this power will rely on BPA's transmission system. It appears that before undertaking the wheeling of this power, BPA will have to study the environmental impact of such action pursuant to NEPA.

The Site C Study Agreement recited the necessity of expanding the Pacific Intertie to approximately 7900 MW if BPA is to provide intertie transmission for the project. The costs for this expansion are not included in the $15 million estimate for transmission improvements in the Northwest.

It must also be noted that access to the Pacific Intertie for Site C power will depend on BPA's Long Term Intertie Access Policy (LTIAP). BPA has proposed for public comment a draft and expects to issue a final policy in Spring 1987. The proposed policy includes the following:

"H. Special Provisions for Canadian Resources

1. "Canadian resources will be granted Assured Delivery only by contract with BPA. Such proposed contract would be evaluated by BPA and reviewed publicly to determine that there is no substantial interference with BPA's Power Marketing Program. Such contract must include benefits to BPA such as increased storage, improved system coordination or operations, or disposition of downstream benefits under the Canadian Treaty beginning in 1998. All transactions would contain as a condition precedent an increase in Intertie capacity to approximately 7900 MW. BPA would expect to conduct a National Environmental Policy Act review of such contracts when the contractual terms and conditions are proposed.

2. BPA may, by contract, provide Canadian utilities limited access to Intertie Capacity under Condition 2. Such access, however, would be conditioned on such utilities' participation in the Pacific Northwests's coordinated planning and operation to a greater extent than in the past or agreement to provide other appropriate consideration of value to the Pacific Northwest.

3. Under Condition 3, Canadian utilities will have access to the Intertie to the extent that Intertie Capacity is available in excess of the capacity used by BPA, Scheduling Utilities and other U.S. Extraregional Utilities."

If the final policy retains these requirements, California utilities may also be involved in any negotiations for the purpose of acquiring firm transmission service through the BPA transmission system.

In addition, BPA would have to develop rates, terms and conditions for wheeling B.C. Hydro's firm power to Northwest utilities, because no rate schedule presently provides for this.

When considering the subject of power delivery, it is important to note that the report of the Technical Working Group discloses the following with respect to present and anticipated use of the Canada/U.S. Intertie:

1. The Canadian/U.S. Intertie and the U.S. transmission system, as planned for 1994, will be capable of delivering 2000 MW on a non-firm basis of which 1200 MW can be considered firm, from the border to and through the Northwest. The $15 million (U.S.) expenditures for system reinforcements south of the Canadian border will increase the transfer capability to 3000 MW non-firm of which 2000 MW can be considered firm.

2. On the Canadian side, transmission additions planned, prior to the Site C development, will maintain firm supply to B.C. Hydro's domestic loads plus the committed firm supply of 250 MW at system peak to Seattle City Light (SCL). If the firm sale of Site C proceeds, additional transmission facilities will be built in Canada to increase and maintain the firm capability deliverable to the border to at least 1055 MW at system peak required for Site C and SCL deliveries.

3. At present, and in the future, there is transmission capacity in the B.C. Hydro system, except at the time of winter peak loads, to provide surplus non-firm power from B.C. Hydro's generating system to the Canada/U.S. Intertie. For example, in the mid-1990's during off peak hours, over 80% of the year, 1500 MW of additional transmission capability will be available for BCH-PNW non-firm transactions on the Canada/U.S. Intertie. Much of the coordinated operation exchanges between B.C. Hydro and the PNW have occurred off peak and therefore the planned transmission system should be able to handle similar ongoing exchanges. Future increases in such transactions will require review of transmission requirements within Canada, the United States, and the Canada/U.S. Intertie.

3.5 CONCLUSION NO. 5

U.S. Federal agency involvement as a purchaser or transmitter of Site C power requires an environmental review process, and will likely include an Environmental Impact Statement (EIS). The process may take as long as 80 to 104 weeks from the date that B.C. Hydro identifies the commodity that will be offered for export sale to the United States. Independent activities for determining rates and negotiating contracts for transmission service should proceed in parallel with the environmental review process. Many Public Agencies require similar but not as lengthy environmental review processes. It is expected that these reviews can be completed within the 80 to 104 week period.

Assumptions:

- Immediately after B.C. Hydro identifies the commodity, BPA commences the environmental review process.
- The process finds that the Canadian environmental review is adequate and that an additional analysis of the impacts of the export sale on the Canadian environment are unnecessary.
- California entities participate in the export sales.
- Extraordinary resources are not devoted to the environmental review process.
- Completion of the environmental review process is not delayed by litigation.
- Commencement of transmission rate development and transmission contracts matters need not await the results of the environmental review process.

Discussion

After B.C. Hydro identifies the commodity that is to be offered for export to the United States, BPA can commence the preparation of an EIS because the source of power to be sold and the marketing plan for such power will be sufficiently identified to analyze the impacts of the sale to the United States. Because of the potential scope of the environmental analysis required for the export sale and the perceived significance of some of the potential impacts on the human environment, it is expected that an EIS would be needed for BPA's participation in the Project.

The extent to which BPA must analyze the impacts of the export sale on the environment of Canada is not clear. However, under any interpretation, environmental analysis of impacts in Canada probably will include a summary of information already available in Canada and additional information that BPA determines is necessary and obtainable with the cooperation of B.C. Hydro and/or other Canadian entities. The length of time to complete the environmental review process depends on the wide variety of assumptions identified within this report.

To address fully the impacts associated with the export sale, all potential purchasers should be identified before the environmental review process begins. Further opportunities for delay may arise if additional purchasers are added later.

A review of the impacts of the construction and operation of Site C on the Canadian environment has been addressed by the British Columbia Provincial Government. A review of the impacts of the export sale on the Canadian environment will be addressed through the environmental review process and is expected to include the results and findings of the provincial government review process of Site C. Extraordinary resources should not be implemented to duplicate prior environmental review.

Transmission wheeling rates must be developed for BPA to provide firm transmission service for the sale of Canadian power to California. BPA transmission service rate schedule development and negotiation of contracts with BPA may be commenced in parallel with the NEPA process, but cannot be concluded until the NEPA process is complete."

4.0 PRECONSTRUCTION SCHEDULE

Before construction of Site C could be authorized, approximately twenty to thirty-one months will be needed to complete U.S. environmental review, Canadian regulatory approval and development and execution of power sale and wheeling arrangements. Twelve preconstruction activities must be completed before construction starts, many of which are interdependent. These activities are shown in Figure 1 and represent the most optimistic schedule only obtainable with strong B.C. Provincial Government and BPA support. Without such support the schedule will extend 2 - 3 years which would jeopardize the viability of the project. A description of these activities and some of the interdependences follows.

- Long-Term Intertie Access Policy IDU/EIS

BPA will consider provision of transmission service to California for Site C power after the final Long-Term Intertie Access Policy has been issued and the nature of the power commodity and likely allocation of power have been adequately defined by B.C. Hydro.

- National Environmental Policy Act (NEPA)

BPA cannot make a final decision concerning wheeling Site C related power to California and the Northwest until it has complied with NEPA requirements. Up to 104 weeks has been identified by BPA to meet NEPA requirements.

- Develop Wheeling Principles and Agreements

BPA will determine whether long-term firm transmission service will be provided to the Northwest and to California and will develop the basic terms and conditions for this service. For wheeling to California, the proposed Long-Term Intertie Access Policy states that BPA will evaluate whether the proposed Site C contracts interfere with BPA's Power Marketing Program, and whether the contracts include adequate benefits to BPA. Such contracts will require negotiations involving BPA, B.C. Hydro and California purchasers.

- Define or Develop Wheeling Rate

A Northwest Power Act s.7(i) process will be necessary to develop appropriate rate schedules.

- Defines Commodity

B.C. Hydro must describe in detail its expectations regarding the terms, principles and prices to the U.S. before negotiations of power sale arrangements can begin.

- Memoranda of Understanding (MOU)

B.C. Hydro shall develop with interested parties a memoranda of understanding. This activity must be completed before regulatory applications are filed with the B.C. Government.

- Conditional Contract

B.C. Hydro shall negotiate, power sales contracts which may be conditional upon occurrence of events such as Canadian regulatory approvals and BPA wheeling assurance. Execution of these contracts would be desirable prior to filing for an NEB export licence.

- Financing

A financing mechanism will be developed concurrent with development of the Conditional Contracts.

- California - Oregon Transmission Project (COTP)

Wheeling to California by BPA is contingent on Intertie expansion, including construction of the COTP. Both completion of U.S. federal and California environmental reviews, and a decision of the California PUC regarding participation in the COTP of investor-owned utilities are required before a decision to construct can be made. The decision may not be made before the summer or fall of 1988.

- B.C. Provincial Process

Before Project and Energy Removal Certificates are issued, the B.C. Ministers of Energy and Environment will require about 6 months for review. This time frame assumes continued active B.C. Government support for the export sale.

- Canadian Federal Process

The National Energy Board will require at least 6 months to review an application and issue an export licence. The Energy Project and Energy Removal Certificates issued by B.C. and sales contracts must be in place prior to any NEB hearing.

- Site Investigations

B.C. Hydro has advised that it would be undesirable to issue tender documents prior to completion of outstanding site investigations which were not completed in 1982. These investigations cannot start until an Energy Project Certificate is approved.

PRE-CONSTRUCTION - OPTIMISTIC SCHEDULE

BPA
- LTIAP IDU/EIS
- NEPA PROCESS
- DEVELOP WHEELING PRINCIPLES
- DEFINE/DEVELOP WHEELING RATE

SITE C POWER SALE CONTRACTS
- BCH DEFINES COMMODITY
- MOU
- CONDITIONAL CONTRACTS
- FINANCING

REGULATORY APPROVAL
- COTP
- PROVINCE APPROVAL
- CANADIAN FEDERAL PROCESS

PROJECT CONSTRUCTION
- SITE INVESTIGATION & ENGINEERING
- INITIAL CONSTRUCTION CONTRACT

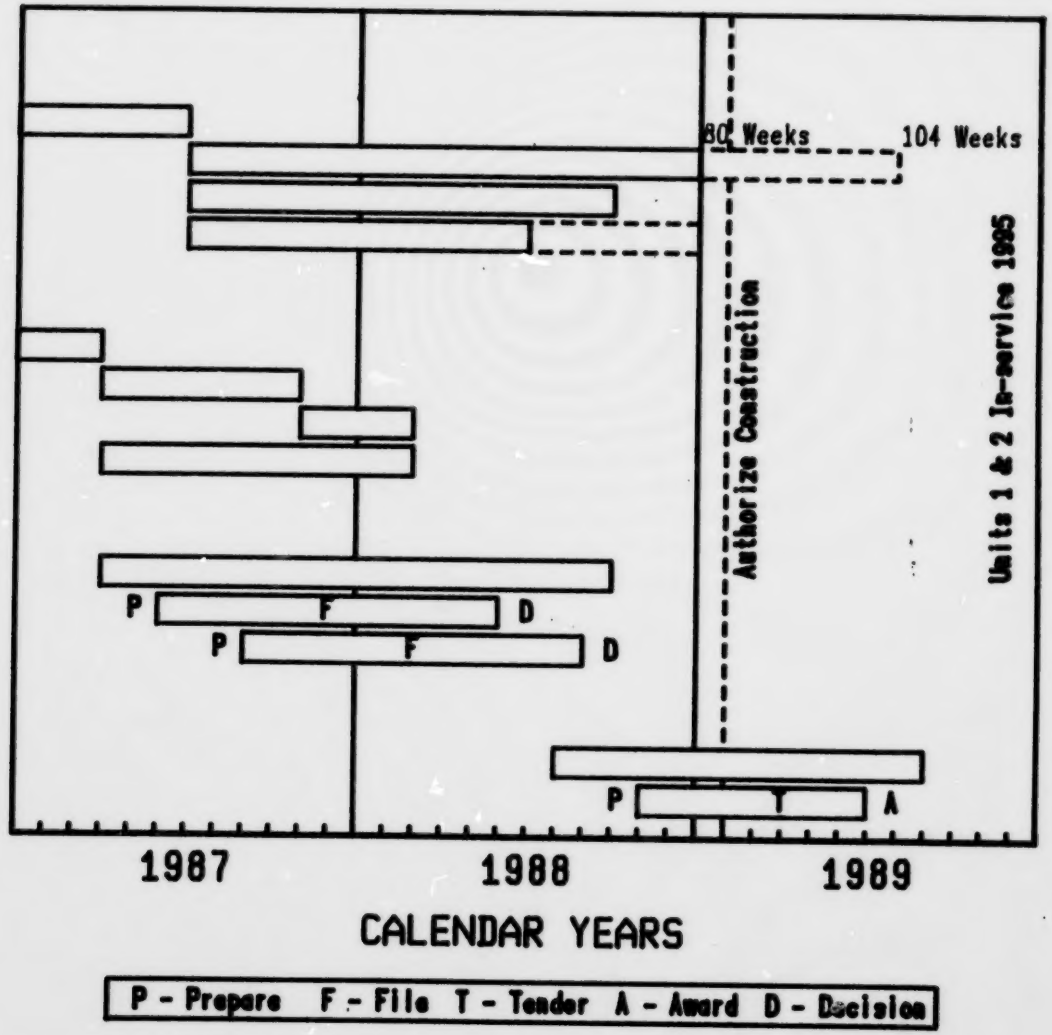

Figure 1
January 1987

Volume

2

PEACE RIVER SITE C - STUDY AGREEMENT

EXECUTIVE COMMITTEE REPORT

VOLUME II

January 1987

SITE C STUDY AGREEMENT

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APPENDIX A

THIS AGREEMENT, dated for reference and effective from the 12th day of June, 1986, by

British Columbia Hydro and Power Authority (B. C. Hydro),
Bonneville Power Administration
and the several utilities in the Pacific Northwest and California
who have subscribed hereto

(the "Signatories"),

WITNESSETH:

WHEREAS, B. C. Hydro has completed the initial design and planning stage for the construction of a hydroelectric generation project on the Peace River, British Columbia, at a location referred to as Site 'C' (the "Project") having an estimated planned installed capacity of 900 MW and an estimated firm annual energy capability of 4600 GWh (525 ave. MW);

WHEREAS, B. C. Hydro is prepared to consider undertaking the construction of the Project and allocating power generated therefrom in excess of domestic requirements for export to the United States under long term firm contracts having economic benefit to British Columbia;

WHEREAS, the Signatories, having expressed an interest in the availability of the Project as a source of long term firm power, wish to have available to them an analysis of the Project's features, the feasibility of delivering power from the Project to markets in the Pacific Northwest states and

California and identification of proposed contract principles for obtaining Project power in order that they may assess the extent, if any, of their participation in the Project or any of the elements associated with the delivery and marketing of its power in those U.S. markets;

WHEREAS, transmission of the power from the Project to California requires that the Pacific Northwest-Pacific Southwest Intertie capability be increased to approximately 7,900 MW, including completion of the Third AC/California Oregon Transmission Project; and

WHEREAS, the transmission of power associated with the Project to California requires contracts with BPA or other Northwest utilities which have an interest in the Pacific Northwest-Pacific Southwest Intertie;

NOW, THEREFORE, the parties do hereby agree as follows:

1. The efficient evaluation of the Project as a source of power for use in the United States requires the undertaking and timely completion of studies designed to identify, examine and assess the technical elements, legal issues and economic factors relevant to the generation, transmission and marketing of the power from the Project and, for that purpose, the Signatories shall support the following working groups and committees.

(a). The Signatories shall establish a Technical Working Group, comprising representatives of each of the Signatories, which shall:

(1). Examine the design, plans, and construction schedules, preliminary cost estimates and in-service date forecasts for the Project;

(2). Analyze the transmission requirements for the delivery of power from the Project to identified market areas in the Pacific Northwest states and California; and

(3). Assess market-specific requirements for each of the identified market areas and the impact of those requirements on the operation of the Project;

(b). The Signatories shall establish a Legal Working Group, comprising representatives of each of the Signatories, which shall:

(1). Identify and propose resolution for any inter-jurisdictional issues arising from the Project and requirements for the transmission and marketing of the power therefrom;

(2). Identify regulatory and environmental approval requirements and assess the impact thereof on the inservice date forecast for the Project.

(3). Identify proposed principles of contractual terms and conditions for obtaining Project power.

(c). The Signatories shall support completion of the working groups' duties and the distribution of reports to the Signatories by the 30th day of November, 1986.

(d). The Signatories shall establish an Executive Committee, comprising senior representatives of each of the Signatories, which shall:

(1). Direct the activities of the working groups, and allocate the administrative and financial aspects of their undertaking;

(2). Assess the information presented by the working groups;

(3). Analyze the feasibility of the Project as a source of power for export to the United States, and submit a report thereon to the Signatories; and

(4). Authorize additional duties for the working groups.

2. Allocation of power generated from the Project for delivery to any identified market area shall be the sole responsibility of B.C. Hydro. In the discharge of this responsibility B.C. Hydro may take into account reservation of power for its domestic load requirements.

3. B.C. Hydro has advised the Signatories that the activities to be performed under this Agreement and any decision to be made with respect to the Project and the marketing of power generated therefrom must comply with

the several statutes and regulations governing B.C. Hydro incorporation and operations and conform with its policies.

4. BPA has advised the Signatories hereto that BPA shall be governed by its statutory authorities and by its policies for the transmission and marketing of power in making decisions regarding the transmission of power from the Project for delivery over BPA's facilities to any identified market area. In making such decisions, BPA advises that it shall consider, among other factors, its responsibility to operate its system to provide inter-regional transmission; the interest of non-Federal utilities; the need, as described by other parties to this Agreement, for long-term firm transmission service for power from the Project; and environmental effects relating to the construction of the Project and the transmission and marketing of power generated by the Project.

5. The Signatories shall direct their best efforts, and extend their full cooperation and support to the achievement of the objectives of this Agreement or any modification thereof approved by all Signatories with the intent that the objective shall be achieved the 30th day of November, 1986. Each of the Signatories reserves to itself the right to determine the extent, if any, of its participation in matters associated with the development of

the Project or the acquisition of power generated therefrom, and to terminate its participation in this Agreement immediately on written notice to the other Signatories.

Subscribed and dated by the Signatories.

British Columbia Hydro and Power Authority

Title Chairman

Bonneville Power Administration

Peter T. Johnson

Title Administrator, BPA

City of Los Angeles, Department of Water and Power

Title General Manager & Chief Engineer

Pacific Gas and Electric Company

George A. Maneatis

Title President

Southern California Edison Company

Title Executive Vice President

Pacific Power & Light Company

Title Vice President

Portland General Electric Company

Title PRESIDENT

Puget Sound Power & Light Company

D. W. Knight

Title Sr. V.P.

Public Generating Pool

Title Managing Agent

San Diego Gas & Electric Company

Title EXEC VICE PRES.

The Washington Water Power Company

D. L. Olson

Title Sr. Vice President

APPENDIX B

PEACE RIVER SITE C

TECHNICAL WORKING GROUP REPORT

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A. CONCLUSIONS

1. INFORMATION PROVIDED BY B.C. HYDRO

The Peace River Site C Project proposed for the export of energy to the United States of America consists of a six-unit 900 MW hydroelectric development on the Peace River near Fort St. John, B.C. and associated transmission line projects with related stations to transmit the energy to the Canada/U.S. border.

- The project would deliver 805 MW of capacity and 4220 GW.h/a of energy at the border. B.C. Hydro would consider the export as a system sale which would permit flexibility and shaping.

- The total direct construction cost for the project would be $1672 million in October 1985 Canadian dollars. A summary of these costs is shown:

Peace River Site C Project
Direct Construction Cost Summary
Generation, Stations, Transmission

		October 1985 Canadian (M$)
Dam and Generating Station		1423
Transmission to Peace Canyon		56
Site C to Peace Canyon T/L	43	
Peace Canyon Sub	13	
Williston to Kelly Lake Transmission		95
Williston to Kelly Lake T/L	71	
Williston, McLeese, Kelly Lake Subs	24	
Kelly Lake to Cheekye Transmission		98
Kelly Lake to Cheekye T/L	83	
Kelly Lake, Creekside, Cheekye Subs	15	
Total Direct Construction		1672*

* Total Direct Construction costs inflated at 4% for October 1986 Canadian dollars is $1739M.

- The earliest in-service date is December 1993 for Unit 1, but this date is now becoming difficult to achieve as it would require receipt of project approval in 1986. It appears that with the current status of negotiations a 1993 in-service date may be unattainable, but a 1994 in-service date may be more realistic.

2. REVIEW OF DESIGN, COST ESTIMATE AND SCHEDULE

A subtask group of engineers and geologists from Pacific Power and Light Company, the Southern California Edison Company and the Pacific Gas and Electric Company visited the project site and interviewed key B.C. Hydro staff responsible for project design and cost.

- It is the opinion of the subtask group that the project appears to be technically feasible, can be built in the construction period of 6 1/2 years and at the defined cost plus or minus 10%. To this 6 1/2 years must be added a "zero" year or years which are necessary to complete further technical investigations, obtain permits and/or licenses, and perform remaining studies. Unless year "zero" can be shortened and/or the construction period compressed, the first two units will probably not be available for commercial service until the Fall of 1994.

3. TRANSMISSION IN UNITED STATES

PACIFIC NORTHWEST

Northwest Transmission review is encompassed by the area defined as:

- Canadian/U.S. border and south
- West of the Idaho/Montana systems
- Oregon/California border and north

- For the mid 1990's time frame, there are no major technical transmission obstacles which would be showstoppers to the delivery of firm B.C. Hydro power to or through the Northwest at the transfer levels studied herein.

- With the recommended reinforcements and possible acceleration of already planned projects, the Northwest "grid" can transfer 805 MW of firm B.C. Hydro power either to Northwest loads or to the Oregon/California border delivery points. These recommended reinforcements will allow deliveries for all seasons and may not be required if the delivery is shaped around the limiting season.

- Environmental concerns are not expected to be of a "showstopper" nature for the required transmission reinforcements because no major additional rights-of-way are required.

- These reinforcements would be relatively "minor" in cost and scale. This assumes acceptable transmission access arrangements can be made by all interested utilities. The alternatives and their costs could radically change if acceptable transmission access arrangements cannot be reached.

- The 1994 U.S. system, as planned, will be capable of delivering 1200 MW firm/2000 MW non-firm from the Canada/U.S. border. Expenditures of approximately $15M (1986, U.S.) will be required to upgrade the U.S. system to enable delivery of 2000 MW firm/3000 MW non-firm from the Canada/U.S. border.

- If deliveries are to the East or within the Northwest, as opposed to deliveries through the Northwest to California the $15M expenditures may be reduced to $12M.

CALIFORNIA

California transmission review includes the Oregon/California interconnection and south.

It is assumed that the following facilities will be in operation by 1993 to accommodate the California participants' share of Site C generation:

- AC Pacific Intertie rated at 3200 MW (measured at Malin Substation).

- DC Pacific Intertie rated at 3100 MW (measured at Celilo Substation).

- COT Project rated at 1600 MW (measured at a southern Oregon substation).

- The present California participants (Los Angeles Department of Water and Power, Pacific Gas and Electric Co., San Diego Gas & Electric Co., and Southern California Edison Co.) have affirmed that their entitlements in the above listed projects are adequate to accommodate their requests for Site C capacity and energy.

BONNEVILLE POWER ADMINISTRATION

The existing transmission interconnections with B.C. Hydro and the major transmission paths to the possible purchasers of Peace Site C power are the property of Bonneville Power Administration. Therefore, access to Peace Site C power must be obtained by agreement with Bonneville Power Administration.

- BPA has indicated to the Technical Working Group and to the Executive Committee that it would expect to wheel Peace Site C power to Northwest utilities for their own needs, subject to appropriate environmental review and

contract negotiations consistent with BPA policies and contracts.

- BPA's proposed Long Term Intertie Access Policy contains provisions which define access for California customers to Canadian power. The final Intertie Access Policy will address access for Canadian power.

- BPA has defined that NEPA compliance activities will have to be completed for any Peace Site C power sale that utilizes BPA transmission.

- The EIS process required for these NEPA activities is expected to take at least 80 weeks. The scope of the EIS should cover construction and operation of the Peace Site C project, transmission in Canada and the U.S., and impacts due to changes in the operation of the Canadian and U.S. power systems.

4. MARKET OPPORTUNITIES

A report combining the California and Northwest Task Groups has been prepared and is presented herein. The California marketing survey includes responses only from the signators of the Agreement. Other Utilities in California may also be interested in a share of Site C power. The Northwest marketing survey includes responses from the majority of investor-owned and publicly-owned utilities in the region. Bonneville Power Administration's interest is included, but has been expressed only as an option to purchase Site C power.

- In total, utilities in the PNW and California expressed the potential requirement for up to 3,091 annual average MW of energy, compared against project capability of 482 MWa. This figure represents 641% of project energy producing capability. The following table reflects the potential capacity demand estimates, by season,

represented as percentages of the 805 MW project capacity at the Canadian border:

TABLE 1

Season	PNW	CALIF	Total
Spring	300%	220%	520%
Summer	344%	220%	564%
Fall	549%	220%	769%
Winter	618%	187%	805%

- These estimates of potential demand, although they total far more than the capability of Site C, are indicative of a large market available for economically attractive long term power resources, including Canadian power. A key assumption used in the preparation of utility responses was that the Site C power would be available at a delivered price competitive with each utility's most attractive alternative resource available during the mid-1990 period.

B. TECHNICAL WORKING GROUP

The Memorandum of Agreement to review Peace Site C as a project for export to the United States was signed on the 12th day of June 1986. The Agreement identified a Technical Working Group to:

(1) Examine the design, and construction schedules, preliminary cost estimates and in-service date forecasts for the Project;

(2) Analyze the transmission requirements for the delivery of power from the Project to identified market areas in the Pacific Northwest states and California; and

(3) Assess market-specific requirements for each of the identified market areas and the impact of those requirements on the operation of the Project.

The Technical Working Group first met on the 28th and 29th of July 1986. At that meeting a number of Task Groups were formed to undertake the various Working Group's assignments. These Task Groups and the utilities responsible for their final reports are as follows:

- Task Group #1, Project Details, B.C. Hydro.
- Task Group #1a, Design Review, S.C.E.
- Task Group #2, Transmission in California, P.G.&E.
- Task Group #3, Transmission to and through PNW, P.P.&L.
- Task Group #4, Market Requirements California, S.C.E.
- Task Group #5, Market Requirements PNW, P.G.E.
- Task Group #6, Final Summary Report, B.C. Hydro.

Three further meetings of the Technical Working Group were held, 10 September 1986 in Seattle, 1 October 1986 in Portland, and 5 November 1986 in San Francisco. The various Task Groups held separate meetings between the Working Group meetings. Diary notes of the four Technical Working Group meetings are included.

SITE C STUDY AGREEMENT
TECHNICAL WORKING GROUP

Notes of Meeting No. 1

Place: B. C. Hydro Board Room
970 Burrard Street
Vancouver, B. C.

Date: 28 and 29 July 1986

In Attendance: See attached list

1. Introduction

All the utilities who are signators to the Site C Study Agreement were represented at the meeting.

2. Review of Agenda

The proposed agenda was discussed and agreed.

3. Discussion on Terms of Reference

The terms of reference for the Technical Working Group included in the Site C Study Agreement were reviewed and discussed:

- The mandate of this group is to provide sufficient information to the Executive Committee to determine if Site C is appropriate for the utilities represented.

- A summary report should come out of each Technical Working Group meeting to be submitted to the Executive Committee.

- A draft report encompassing the findings/conclusions of the Technical Working Group should be in hand by early November 1986, to be submitted to the Executive Committee in early December.

4. Preliminary Discussion on Tasks Required

a) "Examine the design, plans and construction schedules, preliminary cost estimates and in-service date forecasts for the project."

There was much discussion as to the depth of studies necessary to satisfy this task. B. C. Hydro agreed that as stated at the Executive Committee Meeting No. 1, the proposed Site C sale was a sale of the project output backed by the B. C. Hydro system.

It was agreed that a study should be made of the design, costs and scheduling of the project so that each of the participating utilities would feel comfortable going into future negotiations.

B. C. Hydro advised that presentations will be made by B. C. Hydro engineering staff to this Committee to familiarize them with the status of the Site C engineering.

A Task Force should be struck from within the Technical Working Group to examine B. C. Hydro's engineering information and report back to the group.

b) "Analyze the transmission requirements for the delivery of power from the project to identified market areas in the Pacific Northwest states and California."

It was agreed that it would be necessary to examine the transmission capabilities of the transmission systems for delivery of Site C power from the project to all potential customers.

c) "Assess market-specific requirements for each of the identified market areas and the impact of those requirements on the operation of the project."

It is necessary to examine what the customers' requirements will be, make an early assessment of what B. C. Hydro can deliver, and incorporate this with the transmission review.

The group will look at the two markets in the Pacific Northwest and California. They will examine, first as two separate functions for the two district areas, and then jointly, how this affects the transmission requirements.

5. Presentation on the Site C Offering

Doug Forrest addressed the group with respect to the marketing perspective on the Site C sale (see attachment to these notes).

Following the presentation, the following points were confirmed:

- The annual output of Peace Site C is 900 MW capacity and 4570 GWh/a (522 Av MW) energy at site with an estimated contract delivery to the Canada/U.S. border of 805 MW capacity and 4220 GWh/a (482 Av MW) energy.

- B. C. Hydro can will deliver the contracted sale to the Canada/U.S. border under single contingency outages on transmission.

- B. C. Hydro has a large capacity surplus so that generation is not a problem. They would consider a firm contract at the border as part of their generation planning criteria. Firm capacity and energy can be provided even under critical water conditions.

- There would be no reduction in contract sales when units are out for maintenance at Peace Site C generating plant.

6. Technical Presentations on Site C Project

B. C. Hydro engineering staff made presentations to the Technical Working Group on the following:

i) Introduction of the project and status of the engineering.

ii) Review of the design done to date.

iii) Review of the geological investigation program.

Following these presentations, the following material was made available to each member of the Technical Working Group:

a) Report No. 869 - Peace Site C - Preliminary Design Study - Phase I

b) Report No. H1358 - Peace Site C - Preliminary Design Study - Phase II

c) Advisory Board Reports dated 29 September 1978 - No. 1
8 May 1980 - No. 2
5 May 1981 - No. 3
16 October 1981 - No. 4
23 June 1982 - No. 5

d) Construction Schedule Drawing SK86-7-4 R0

e) Construction Costs (Generation only) - 17 July 1986 (Table 1)

f) Transmission Costs (Table 5-2)

g) Site C - substation expenditures by fiscal year (15 July 1986).

7. Establish Working Group Activities and Schedule

For purposes of this working group, it was agreed that the following assumption would be adopted:

"It is B. C. Hydro's intention that Site C be built and put in place earlier than requested into their system, in order to permit a firm export sale of the equivalent output of the project with the output supported by the entire B. C. Hydro system."

Each utility will be required to satisfy itself that the project is technically feasible, how the power would be transmitted, and that it can be built for the cost and in the time frame indicated. How such information will be used in negotiations is beyond the terms of reference for this group.

It was agreed that the Technical Working Group would meet as follows:

September 10	-	Seattle
October 1	-	Portland
November 5	-	San Francisco
December 3	-	Vancouver

Meetings will generally run from 8:30 a.m. to 3:00 p.m.

8. Review Needs for Task Forces

It was agreed that the work of the Technical Working Group should be assigned to small Task Force groups with one utility designated to lead and to include others as appropriate. These Task Forces would meet separately and report to the Technical Working Group as a whole.

For the September meeting, the Task Forces are to be prepared to discuss their proposed terms of reference, range of items to be covered in their report and the structure of the final report.

The attached schedule of Task Groups and Activities was agreed.

9. Working Relationship with the Executive Committee

The Executive Committee will meet monthly and wishes to review reports from the Technical and Legal Working Groups at each meeting. At the next meeting, the Executive Committee wishes to review the degree of in-depth studies which the Technical Working Group is proposing to undertake.

The Executive Committee have requested that an administrative budget be established by B. C. Hydro to cover costs of meetings or other common costs. These costs will be shared between the participating utilities. Each utility will otherwise carry their own costs associated with the Site C Study Agreement.

Any additional costs anticipated by the Technical Working Group shall be approved by the Executive Committee prior to any commitment being made.

It was agreed that at the August 14 Executive Committee meeting, the Technical Working Group will provide a schedule of their meetings, together with the identified tasks and task leaders. Design details should be available for the October meeting so that preliminary Task Force reports can be submitted in October and final reports by November.

The last meeting of the Technical Working Group is scheduled for 3 December so final reports will be available for the December Executive Committee meeting.

The Executive Committee will be asked to approve these schedules.

10. Next Meeting

Set for Seattle on 10 September. Mr. T. McGrath offered to assist in arranging a meeting place.

In Attendance:

Bonneville Power Administration:	J. Jones
B. C. Hydro and Power Authority:	C. W. Boatman D. R. Forrest * ~~J. E. Hardy~~ ** D. G. McFarlane
City of Los Angeles, Dept. of W&P:	D. J. Mahoney H. W. Rupp
Pacific Gas and Electric Company:	R. Haywood
Pacific Power and Light Company:	F. E. Hammerquist
Portland General Electric Company:	L. Kellerman
Puget Sound Power and Light Company:	T. J. McGrath
Public Generating Pool:	G. Lubking G. Kunkel
San Diego Gas and Electric Company:	J. G. Mounts
Southern California Edison Company:	R. L. Maurel
The Washington Water Power Company:	M. Schultz (July 28 only)

* for marketing presentation only and questions thereto

** for transmission presentation only and questions thereto

Site C Study Agreement
Technical Working Group

Notes of Meeting #2

Place - Seattle - Tacoma Airport
Room - 47A

Date - September 10, 1986

1. In Attendance - (Attachment 1)

2. Review of Agenda (Attachment 2)

No changes

3. Review of Notes of Meeting #1

No significant comments

4. Review of Technical Working Group Report to 14 August Executive Committee

- D. McFarlane briefly discussed the report and indicated that the next executive committee meeting is presently scheduled for Sept. 24 in Vancouver. He pointed out that subsequent executive committee meeting dates may change but that the TWG will continue on their present meeting schedule until more is known of the E.C. schedule.

- Reports from the Technical Working Group to the Executive Committee are to be available for mailing to the Executive Committee prior to their meeting date.

5. Report of Task Groups

Task Group #1: Project Details

i) Transmission in B.C. - Attachment 3

J.E. Hardy presented the material contained in Attachment 3. The question arose as to whether the 1055 MW firm capacity (305 MW Site C plus 250 MW Skagit) would be available on top of the existing 2000 MW intertie capacity. It was indicated that resources and transmission costs would have to be further reviewed before this could be answered.

It was questioned how much of the described additional transmission facilities would be charged to Site C. Because of the staging of these additions, present worth analysis would be necessary but is expected to be about equivalent to the cost of the Kelly Lake - Cheekye line at the Site C in-service date.

Discussion took place on the capability of the transmission connections at the Canadian - U.S. border. The present 2000 MW rating is a non-firm rating. The firm rating is at least 1050 MW. B.C. Hydro has no plans at present to increase these tie line capabilities.

A suggestion was made that if B.C. Hydro resources and transmission were adequate, a system sale could start before completion of Site C.

ii) Design Review - (Attachment 4)

R.L. Maurel reported:

- Considered Site C site conditions difficult but construction is feasible.
- Slides should not be a problem.
- Most materials are there.
- Ice well studied and should not be a problem.
- Environmental studies look good but more fish studies may be required.
- Will write an executive summary concentrating on costs and schedules.
- Corps of Engineers will look over the material obtained by R. Maurel.
- Question as to whether Site C output would be influenced by co-ordinated operation.
- D.G. McFarlane discussed the basis of O & M and indicated that these would be released by the next meeting, or before if ready. Agreed to send when ready.

Task Group #2: Transmission in California

R. Haywood reported:

- Need marketing information before transmission can be addressed.
- Cliff Young of PG & E coordinating.
- Preliminary draft by next meeting, final draft early November.

Task Group #4: Market in California (Attachment 5)

R. Maurel reported:

- Have summer and winter load shaping but some disagreement as to best actual shapes. Must also consider requirements in the N.W.

. . . /3

Task Group #3: Transmission in PNW (Attachment 6)

R.S. Bayless reported:

- Need marketing information on shape and location.
- Assumptions

  Load levels
  Transactions to be retained
  Loop flow
  Definition of firm rating
  What facilities should be considered

- B.C. Hydro must indicate availability of secondary energy.
- Group is ignoring the intertie access policy.
- Access policy being developed by BPA is not yet complete and will not likely be complete in time for this study.
- No mandate for technical committee to address intertie access policy, or contract path.
- May have to do study on a seasonal basis.
- BPA wheeling - see Item C3 of Attachment #6. We can assume for purposes of this study that 805 MW will be wheeled to loads in the Northwest and to the California - Oregon Border. Intertie access policy considered a separate issue.

Task Group #5: Market in PNW (Attachment 7)

L. Kellerman reported:

- Attempting to shape to maximize benefits, particularly if there is an economic benefit to taking off-peak.
- They are making the following assumptions:

  1. Assume that there is no pricing differential between on-peak and off-peak. For this review assume that contract take is at the load factor of the plant.
  2. Contract level should be assumed to be the same each year but interest in variations to this could be identified.
  3. Will not constrain peaking take to the fall and winter period in the N.W. There may be interest in peaking sales during other times.
  4. N.W. Utilities who are not signatories will be considered.
  5. Assume an X% off-peak
     Depends on needs of utilities.

. . . /4

6. Executive Committee Meeting, September 24

- Provide preliminary cost and schedule.
- Marketing and Transmission.
- With today's minutes DGM will draft report to Ex. Comm. and telecopy out to TWG members before Ex. Comm. meeting for comment.
- Each Task Group to summarize their inputs and telecopy to DGM by September 11.
- DGM will telecopy back a copy of the draft Ex. Comm. report.

7. Other Questions

- Will non-signatories be offered Site C Power. Will not necessarily be limited to signatories. Do not need to poll non-signatories.
- Are we selling Site C Power or B.C. Hydro system power? The amount of the sale will be based on the annual Site C output. The source of the sale will be the B.C. Hydro power system.

8. Next Meeting - Portland, October 1, 9:30 A.M. start.

Airport Sheraton

- Chris Boatman to make arrangements for Hotel meeting facilities and lunch. All committee members should make their own personal reservations.

JEH/kg

ATTACHMENT 1

In Attendance:

Company	Name	Affiliation
B.C. Hydro	Don McFarlane	Member
	Jack Hardy	Guest
	Chris Boatman	Alternate
Los Angeles, Department of Water and Power	Horace Rupp	Member
	Andreas Taeubel	Guest
Bonneville Power Administration	Gary Fuqua	Member
Pacific Gas and Electric Company	Bob Haywood	Member
Portland General Electric Company	Larry Kellerman	Member
Southern California Edison Company	Ron Maurel	Member
	Dennis Dayne	Guest
Public Generating Pool		
Eugene	Garry Kunkel	Member
Chelan	Gene Lubking	Alternate
Washington Water Power Company (ICP)	Merrill Schultz	Member
Puget Sound Power and Light Company	Tom McGrath	Member
	Rich Lauckhart	Alternate
San Diego Gas and Electric Company	Gerald Mounts	Member
Pacific Power and Light Company	Rich Bayless	Alternate

ATTACHMENT #2

TECHNICAL WORKING GROUP
SITE C STUDY

Meeting No. 2: 10 September 1986
Room M-47A, Sea-Tac Airport

A G E N D A

8:30 A.M. a) Meeting to Order

b) Review of Agenda

c) Review of Notes of Meeting No. 1

d) Review of Technical Working Group Report to 14 August Executive Committee meeting

e) Report of Task Group's

- #1 Project Details

  (i) Transmission in B.C., J.E. Hardy

  (ii) Design Review, R.L. Maurel

- #2 Transmission in California, R. Haywood

- #3 Transmission in PNW, R.S. Bayless

- #4 Market in California, R.L. Maurel

- #5 Market in PNW, L. Kellerman

f) Report to Next Executive Committee Meeting

g) Next Meeting Technical Working Group

DGM/jb
3 September 1986

20/5/207

Site C Study Agreement
Technical Working Group

16 October 1986

Notes of Meeting #3

Place - Sheraton Hotel - Portland Airport

Date - 1 October 1986

1. In Attendance - Attachment 1

2. Review of Agenda - Attachment 2

No changes

3. Review of Notes of Meeting #2

No comments

4. Review of Technical Working Group (TWG) Report to 24 September Executive Committee

- D. McFarlane briefly discussed the report and noted that the next Executive Committee meeting is scheduled for 13 November.

- Regarding transmission access from Canada to the PNW, BPA indicated that firm wheeling would be provided to PNW customers for their own requirements. BPA also indicated that the Long Term Intertie Access Policy is not expected to be finalized until the end of May 1987.

- The Executive Committee assigned two further tasks to members of the TWG:

  (i) BPA was requested to define the environmental studies that would be needed for a Peace Site C sale. G. Fuqua stated that BPA would need further definition of how the contract(s) would be structured, but D. McFarlane suggested that the main task now would be to outline the process that would be followed.

  (ii) BPA and BCH were asked to define the existing benefits that PNW utilities would forego if the Canada/U. S. intertie is partially loaded in the future with firm energy sales from Peace Site C.

- D. McFarlane indicated that the TWG would be required to have a final draft of the marketing report available by the 5 November meeting of the TWG in order that it could be forwarded to the Executive Committee prior to their meeting on 13 November.

- C. Boatman reported that at the Executive Committee meeting each member was asked to consider financing options for development and sale of the Peace Site C project.

5. Report of Task Groups

(i) Project Details

D. McFarlane distributed a draft report titled "Peace River Site C - Generation and Transmission Project Details". He indicated that interest during construction and overheads were not included in the Peace Site C cost estimates (which are shown in Canadian dollars).

R. Maurel distributed a draft report titled "Peace River Site 'C' - Project Review - Task 1A". R. Maurel provided a brief review of the report which concludes that the project appears feasible.

D. McFarlane noted that the two reports should be consolidated into a final report to the Executive Committee and reviewed to ensure that project cost estimates are consistent.

(ii) Transmission in California

C. Young discussed a work plan titled "Site C California Transmission - Task Group Assignment" which was sent out in a letter dated 12 September 1986 (Attachment 3). C. Young noted that further work on the report must await a final determination of allocation of Peace Site C output to California utilities. D. McFarlane suggested that the report should be kept simple and state that, unless there are obvious bottlenecks, the system can accommodate each utility's reasonably expected share of Peace Site C on the existing and planned transmission system.

(iii) Transmission in the PNW

R. Bayless reported on the work of the PNW transmission task group. The study work is identifying the firm and non-firm transmission capability into the PNW and through the PNW to the California intertie. The studies are also identifying system reinforcement required to raise the firm capability from the BCH system to the PNW to 2000 MW, and the total capability to 2800 MW.

The task group is scheduled to meet again in a week and will be looking at further cases involving power delivered to Seattle, Hatwai and Malin.

(iv) Market in California

R. Maurel distributed a report titled "Peace Canyon Site 'C' - Marketing Response Summary - California Utilities" (Attachment 4). The project's output of 805 MW is oversubscribed by the California utilities by as much as 220%. It was noted that the decision on allocation amongst the PNW and PSW would not be addressed by the TWG.

D. McFarlane noted that it will be necessary for Messrs. Maurel, Kellerman and Forrest to prepare a joint marketing report once the information is available from the PNW.

(v) Market in PNW

Y. Linn reported that not all responses were in from PNW utilities. D. McFarlane requested that D. Forrest call L. Kellerman during the week of 6 October and assist, if possible, in completing the PNW report.

6. Other Activities

D. McFarlane distributed a report "Peace Site C - Operating Costs". It was noted that the cost estimates for Peace Site C were not consistent with the earlier reports on project details.

Post Meeting Note: Corrected values are included in Attachment 5.

7. Report to Executive Committee

The next report for the Executive Committee will be prepared after the 5 November meeting of the TWG.

Post Meeting Note: Due to recent surgery on BCH Chairman, C. A. Johnson, the 13 November Executive Committee meeting has been delayed.

8. Next Meeting of the TWG

The next meeting of the TWG is scheduled for Wednesday, 5 November in San Francisco. PG&E will organize the meeting room, likely at the Hilton or Sheraton hotel at the San Francisco airport at 9:30 a.m.

Attachments
DRF/pb

Attachment 1

Site C Study Agreement
Technical Working Group
1 October 1986

In Attendance:

Company	Name	Affiliation
B. C. Hydro	C.W.J. Boatman	Alternate
	D. R. Forrest	Guest
	D. G. McFarlane	Member
Los Angeles Department of Water and Power	H. W. Rupp	Member
	A. Taeubel	Guest
Bonneville Power Administration	Gary Fuqua	Member
Pacific Gas and Electric Company	Cliff Young	Guest
Portland General Electric Company	Young S. Linn	Guest
	W. E. Mays	Guest
Southern California Edison Company	D. G. Dayne	Guest
	R. L. Maurel	Member
Public Generating Pool Chelan	Gene Lubking	Alternate
Washington Water Power Company (ICP)	Merrill Schultz	Member
Puget Sound Power & Light Company	Rich Lauckhart	Alternate
San Diego Gas & Electric Company	Keith McKinnon	Guest
Pacific Power & Light Company	Rich Bayless	Alternate
	S. A. deSousa	Member
	Ron Handlin	Guest

Attachment 2

TECHNICAL WORKING GROUP

SITE C STUDY

Meeting No. 3: 1 October 1986

Sheraton Hotel, Portland Airport

AGENDA

9:30 A. M.

a) Meeting to Order

b) Review of Agenda

c) Review of Notes of Meeting No. 2

d) Review of Technical Working Group Report to 24 September Executive Committee Meeting

e) Report of Task Group's

- #1 Project Details
- #2 Transmission in California
- #3 Transmission in PNW
- #4 Market in California
- #5 Market in PNW

f) Other Activities

g) Report to Executive Committee

h) Next Meeting Technical Working Group

Site C Study Agreement
Technical Working Group

26 November 1986

Notes of Meeting #4

Place - San Francisco Airport Hilton

Date - 5 November 1986

1. In Attendance - Attachment 1

2. Review of Agenda - Attachment 2

No changes

3. Review of Notes of Meeting #3

No comments

4. Reports

(i) Task Group #1: Project Details

D. McFarlane distributed a revised draft report titled "Peace River Site C - Generation and Transmission Project Details", dated 4 November 1986. He noted that the estimated costs shown in the tables are based on a 1993 in-service date and can be shifted by one year for a 1994 in-service date. He also noted that page 4 of the report sets out the constraints of the BCH system to export secondary energy over and above a committed firm export contract.

(ii) Task Group #2: Transmission in California

C. Young distributed a report titled "Site C Project - California Transmission Task Group", dated 5 November 1986. The report states that the California participants have affirmed that the transmission facilities that are assumed to be in operation by 1993 will be adequate to accommodate their requests for Site C capacity and energy.

(iii) Task Group #3: Transmission in PNW

R. Bayless distributed a report titled "Canadian Site C Project, Task Group #3, Northwest Transmission - Report on Initial Investigations", dated 4 November 1986. He indicated that the report should be categorized as a feasibility study as there was not sufficient time to develop a detailed planning report. Transmission reinforcements identified in the report were based on a least cost analysis which assumed that acceptable transmission arrangements can be made by purchasing utilities. The report concludes that with recommended transmission reinforcements there would be no technical problems that would prevent the Northwest grid from transferring 805 MW of firm BCH power to Northwest loads or to the Oregon/California border.

(iv) Task Groups #4 and #5: Market for Site C

Y. Linn, representing L. Kellerman, PGE, distributed a report titled "California and Pacific Northwest Market - Specific Power and Shaping Requirements for Site C/BC System Power", dated 3 November 1986. It was noted that in some cases higher monthly outputs than Site C capacity are shown, but on an annual basis energy allocation was limited to Site C project output. G. Fuqua noted that the report should indicate BPA's interest in an option on Site C power.

(v) Surplus Marketing Limitations of Canada/US Intertie

G. Fuqua distributed a BPA draft paper "Canadian Intertie". BPA has compiled a summary of the uses of the Canada/US Intertie from 1 January 1983 to 30 September 1986, showing transactions under 4 categories. D. Forrest briefly discussed a draft paper being prepard by BCH which would look at the transmission capability of the BCH system, Canada/US Intertie and the US PNW system to handle firm and non-firm transactions in the future.

M. Schultz noted the paper should indicate that additional coordinated operation may occur in the future but that most exchanges occur off peak and the transmission system should be able to handle such transactions. The paper should also recognize the uncertainties in future transactions, in particular the possibility that downstream power benefits under the Columbia River Treaty will be returned to Canada.

It was agreed that Messrs. Forrest and Fuqua would collaborate to produce a final report.

(vi) Environmental Review of Site C Purchase

G. Fuqua distributed a paper titled "Environmental Issues Relating to Site C". He noted that the draft EIS for the Long Term Intertie Access Policy does not include an environmental analysis of a possible Site C purchase, and additional environmental work would be needed even if BPA is not a direct purchaser. G. Lubking noted that public agencies in Washington State would have to go through a similar process to that described by BPA. However, investor-owned utilities in the PNW do not have to follow the same environmental process as BPA or the public agencies. It was noted that the process would require from one to two years. If BPA takes an option on Site C it would not have to go through the NEPA process at the start.

5. Final Report to Executive Committee

D. McFarlane briefly outlined the conclusions of the Technical Working Group activities that he will include in a draft report to the Executive Committee. The draft report will be distributed to the Executive Committee by mid-November, and will also be sent to the Task Group Chairmen for their review prior to distribution to the Executive Committee. The report would not recommend any further work or studies by the Technical Working Group.

6. Future Work

Mr. McFarlane thanked all the participants involved in the preparation of the various reports and indicated that he expected this would be the last meeting of the Technical Working Group.

DRF/pb
Attachments

Attachment 1

Site C Study Agreement
Technical Working Group
5 November 1986

In Attendance:

Company	Name	Affiliation
B. C. Hydro	Chris Boatman	Alternate
	Doug Forrest	Guest
	Don McFarlane	Member
Los Angeles Department of Water and Power	Hoddy Rupp	Member
Bonneville Power Administration	Gary Fuqua	Member
Pacific Gas and Electric Company	Garth Hall	Alternate
	Cliff Young	Guest
Portland General Electric Company	Young Linn	Guest
Southern California Edison Company	Dennis G. Dayne	Guest
Public Generating Pool		
Eugene	Garry Kunkel	Member
Chelan	Gene Lubking	Alternate
Washington Water Power Company (ICP)	Merrill Schultz	Member
Puget Sound Power & Light Company	Bill Gaines	Alternate
San Diego Gas & Electric Company	Jerald G. Mounts	Member
Pacific Power & Light Company	Rich Bayless	Alternate

Attachment 2

TECHNICAL WORKING GROUP

SITE C STUDY

Meeting No. 4: 5 November 1986

San Francisco Airport Hilton

AGENDA

9:30 A. M.

a) Meeting to Order

b) Review of Agenda

c) Review of Notes of Meeting No. 3

d) Reports:

- Impact on marketing on US/Canada intertie by the Peace Site C firm sale.
- Process that BPA would require for an environmental review for a Peace Site C purchase.
- Task Group #1: Project Details

  B.C. Hydro internal transmission capability
- Task Group #2: Transmission in California
- Task Group #3: Transmission in PNW
- Task Group #4 and #5: Market for Site C

e) Final Report to Executive Committee

f) Other Concerns

g) Future Work

h) Next Meeting Technical Working Group

C. REPORT OF TASK GROUP #1

GENERATION AND TRANSMISSION PROJECT DETAILS

Three presentations were made to the Technical Working Group by B.C. Hydro staff:

(1) Site C Offering, peak and energy
D.R. Forrest, Manager, Power Marketing

This presentation identified the annual output of the proposed Site C project as follows:

	Energy		Capacity
	GW.h/a	(Av.MW)	MW
At site	4570	(522)	900
At Canada/U.S. border	4220	(482)	805

The delivery arrangements were indicated to be flexible in that the sale would be considered a system sale at the border rather than the actual Site C project output.

(2) Site C Project, design review, cost and schedule
C.K. Harman, Manager, Engineering Projects

This presentation was made by B.C. Hydro's engineering staff and included the following:

- Introduction of the project and status of the engineering.
- Review of the design done to date.
- Review of the geological investigation program.

Following this presentation, copies of several design study reports, Site C Advisory Board reports, construction costs and schedules were provided to the members of the Technical Working Group.

(3) Transmission in B.C., Peace Site C for export
J.E. Hardy, Manager, System Planning

This presentation identified the transmission requirements within B.C. Hydro that would be constructed to deliver Peace Site C power to the Canada/U.S. border.

The results of these presentations are provided in the attached report of Task Group #1.

B.C. HYDRO

PEACE RIVER SITE C

GENERATION AND TRANSMISSION PROJECT DETAILS

19 November 1986

Site C Technical Working Group

Task Group No. 1

VR470

PEACE RIVER SITE C
GENERATION AND TRANSMISSION PROJECT DETAILS

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5	Site C Implementation Plan General Schedule

1.0 SUMMARY

The Peace River Site C Project for the export of energy to the United States of America consists of a six-unit 900 MW hydroelectric development on the Peace River near Fort St. John, B.C. and associated transmission line projects with related stations to transmit the energy to the Canada/U.S. border.

The project would deliver 805 MW of capacity and 4220 GW·h/a of energy at the border. B.C. Hydro would consider the export as a system sale which would permit flexibility and shaping.

The total direct construction cost for the project would be $1672 million in October 1985 dollars for a 1993 in-service date. A summary of these costs is shown on Table 1.

The earliest in-service date is December 1993 for Unit 1 but this date is now becoming difficult to achieve as it would require receipt of project approval in 1986. It appears that with the current rate of study activity, a 1993 in-service date may be unattainable and a 1994 in-service date may be more realistic. The estimated costs shown in the tables are based on a 1993 in-service date and should be shifted by one year for a 1994 in-service date.

2.0 PROJECT OUTPUT

The Peace River Site C Project would have an at site nominal capacity of 900 MW and an annual energy capability of 4570 GW·h.

The energy from the Project would be transmitted through the B.C. Hydro system to the Canada/United States border. The output available at the border would be 805 MW of capacity and an annual energy capability of 4220 GW·h.

The B.C. Hydro system presently exceeds 10 000 MW of capacity of which 90 percent is hydroelectric. The transmission network is primarily 500 kV. The system would allow some flexibility and shaping of Site C output to suit the conditions of sale. This flexibility would permit the following:

1. Export of electricity from Peace Site C would be considered a system sale at the Canada/U.S. border (i.e. not based on actual Peace Site C project output).

2. Deliveries could be adjusted during the period 15 April to 15 June to be compatible with overgeneration caused by the fish flow operation on the Columbia River.

3. Maximum monthly energy deliveries could be in the range of 500 to 600 GW·h.

4. Daily and weekly load shaping could be provided.

3.0 GENERATION PROJECT

(a) Project Description

The Site C Project would be located on the Peace River, 7 km southwest of the City of Fort St. John and immediately downstream from the confluence of the Moberly River. The general project arrangement is shown on Fig. 1.

The proposed project would raise the water surface by about 50 m at the dam and the reservoir would extend 80 km upstream to the tailwater of the Peace Canyon Project near Hudson's Hope, B.C.

The project would comprise an earthfill dam across the river, and spillway, power intake structure, powerhouse and switchgear facilities on the right bank (viewing downstream).

The earthfill dam across the river would be about 1100 m long and up to 70 m high above the bedrock foundation. The dam would be a zoned embankment structure consisting of a central impervious core flanked by filters and pervious shell sections. Grouting under the dam core would be carried out, foundation pressure relief drain holes would be drilled and instrumentation would be installed as required to monitor long-term performance of the foundation and embankment.

The spillway, with a discharge capacity of 16 600 m^3/s, would consist of a concrete headworks structure with six radial gates. Downstream of the headworks structure a concrete-lined chute would lead to a concrete-lined stilling basin.

The power intake structure adjacent to the spillway would contain six gated intakes, and penstocks would connect with the six-unit powerhouse which would have a rated output of 900 MW. Power would be brought out to separate switchgear facilities adjacent to the powerhouse.

During construction of the dam, the river flow would be diverted through two concrete-lined tunnels in the left abutment and fill cofferdams would facilitate dewatering of the foundation area.

Extensive excavation would be carried out on the left and right banks for long-term slope stability, and to provide suitable foundations for the concrete and earthfill structures.

(b) Cost Estimate

B.C. Hydro is presently updating the project cost estimate. The June 1986 update for the generating station and dam is attached as

Table 2. The total construction cost of the dam and generating station is now $1423 million in 1985 dollars. The cost estimate includes 13 percent contingencies which is appropriate for the level of project knowledge.

A summary cost estimate and distribution for a first unit in-service of December 1993 is attached as Table 3.

4.0 TRANSMISSION SYSTEM REQUIREMENTS IN BRITISH COLUMBIA

(a) Introduction

B.C. Hydro's existing 500 kV transmission network is shown in Fig. 2. Also shown is the proposed staging of future generation and transmission projects to 2002/03 if Peace Site C is advanced to 1993/94.

B.C. Hydro's system planning criteria require that the system be capable of withstanding first contingency disturbances with no loss of load or generation while serving peak domestic load. The system response to a first contingency disturbance must be stable, and post-disturbance voltages must remain within acceptable limits. Firm exports are added to the peak domestic load when testing the system's ability to meet this criterion. The proposed firm export in 1993 amounts to an 805 MW step increase in Lower Mainland load in terms of its effect on B.C. Hydro's transmission requirements.

The present B.C. Hydro transmission system has limited firm capacity export capability under peak load conditions and this capability is dependent upon balancing the schedules of the Columbia and Peace River systems. If either river system had to be operated at full capacity, generation shedding is required for certain first contingency disturbances. It has a non-firm export capacity as high as 2000 MW depending on domestic load level and on both domestic and foreign generation dispatch schedules.

(b) Transmission Requirements

Some upgrading and strengthening of the system is planned for completion before 1993 to relieve operating restrictions and to accommodate expected load growth:

1. Some 500 kV Peace River lines will be retensioned to obtain higher summer capacities.

2. The 230 kV Selkirk-Nelway-Boundary intertie will be uprated or, alternatively, phase shifters will be installed.

3. The 500 kV Nicola-Meridian and Nicola-Ingledow lines will be series compensated to 50 percent.

In determining the transmission requirements for Site C it was assumed that the above developments would already be in service; they were not included in the Site C cost estimates. In addition, the following assumptions were made:

1. Firm supply to Seattle City Light is considered to be 250 MW on peak (Skagit Agreement).

2. Interchanges with TransAlta Utilities (TAUC) would be made only if they did not adversely impact the firm export of 1055 MW of firm power (805 Site C plus 250 Skagit). No interchanges with TAUC were assumed in the studies to determine transmission requirements for Site C.

3. The Columbia Downstream Benefits would be returned to B.C. and become a B.C. Hydro resource. [If these are not returned to B.C. (as assumed in the Task Group #3 report) then the Site C transmission additions outlined below would have to be further augmented.]

Studies to date have shown that the following additions would provide the necessary transmission system capability to deliver 1055 MW firm power at any time from 1993 through to at least 2002:

1. Construct two 500 kV transmission lines and associated station terminations between Site C and Peace Canyon in 1993.

2. Construct the third 500 kV transmission line and associated station terminations between Williston and Kelly Lake sub-stations in 1993 (50 percent series compensated).

3. Install a 340 Mvar static var compensator (SVC) at Ingledow in 1994 to supply Lower Mainland reactive power requirements.

4. Construct another 500 kV transmission line and associated station terminations from Kelly Lake Substation into the Lower Mainland (e.g. a second Kelly Lake to Cheekye line) sometime between 1999 and 2002 (50 percent series compensated).

5. Install a 400 Mvar SVC on the Nicola 500 kV bus or construct another 500 kV line into the Lower Mainland from Nicola (e.g. a second Nicola to Meridian line) sometime between 1999 and 2002 (50 percent series compensated).

The ability of the B.C. Hydro system to export secondary non-firm energy at any time over and above the committed firm export will be a function of:

1. The amount of peaking secondary energy resources available.

2. The timing of the step transmission additions described above.

3. The amount of domestic peak load to be served in the Lower Mainland-Vancouver Island regions of B.C.

4. The daily and annual timing of the secondary energy delivery. The rate of delivery would be approximately equal to the amount by which the above peak domestic load exceeds the daily domestic load at the time of delivery.

B.C. Hydro will, as at present, provide sufficient transmission facilities to meet its firm commitments but will only deliver secondary energy to the extent those facilities will allow at the time, unless it can be shown that additional facilities can be justified to meet demands for secondary energy.

(c) Transmission Line Design

Figs. 3 and 4 depict typical 500 kV self-supporting and guyed suspension tower designs and Table 4 presents mechanical and electrical characteristics typical of 500 kV lines that would be constructed as part of the Site C Project. The information presented in Figs. 3 and 4 and in Table 4 is not final and some changes can be expected at the final design stage.

(d) Cost Estimates

Table 5 presents a summary of the direct costs of the transmission lines in British Columbia associated with the Peace Site C Project. Table 6 presents the associated substation costs for line terminations and series capacitors. The transmission requirements outlined above will undoubtedly be staged to suit the machining of Site C and to cater to the domestic load growth rate. Present worth costing of such staged development south of Kelly Lake-Nicola is not expected to exceed the direct cost of the Kelly Lake Cheekye line and associated station work listed in Tables 5 and 6.

5.0 SCHEDULES

The attached Fig 5 is a Site C Implementation Plan General Schedule. The information provided to date has been for a 1993 first unit in-service date. This makes 1993 year 7 on Fig. 5. Working backwards, 1986 becomes year 0 which means project approval would be needed by the end of the year which does not appear likely in view of the current study activities. It may be more realistic to assume a December 1994 earliest first unit in-srvice date.

The transmission and substation projects are not on the critical path for the export of Site C energy.

TABLE 1

PEACE RIVER SITE C PROJECT
DIRECT CONSTRUCTION COST SUMMARY
GENERATION, STATIONS, TRANSMISSION

November 1986 update for 1993 in-service

		October 1985 Canadian (M$)
Dam and Generating Station		1423
Transmission to Peace Canyon		56
Site C to Peace Canyon T/L	43	
Peace Canyon Sub	13	
Williston to Kelly Lake Transmission		95
Williston to Kelly Lake T/L	71	
Williston, McLeese, Kelly Lake Subs	24	
Kelly Lake to Cheekye Transmission		98
Kelly Lake to Cheekye T/L	83	
Kelly Lake, Creekside, Cheekye Subs	15	
Total Direct Construction		1672*

Note: * Total Direct Construction costs inflated at 4 percent for October 1986 Canadian dollars is $1739 million.

VR470

PEACE SITE C (DEC93 ISD #300)
SUMMARY COST ESTIMATE & DISTRIBUTION OF EXPENDITURES BY FISCAL YEAR
BY PROJECT FEATURE

ORIG ESTIMATE DOLLAR BASE OCT 85
CURRENT PRICE LEVEL DATE OCT 85
ESCALATION FACTOR 1.000
COST IN $ MILLIONS

IDENTIFICATION	TOTAL	PRIOR	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96
INFLATION FACTORS			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
EFFECTIVE INFLATION			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
****THE FOLLOWING FIGURES ARE NOT INFLATED****												
01 LANDS AND RIGHTS	35.2	5.9	1.5	4.1	3.2	5.2	4.7	4.0	2.0	1.7	2.2	.7
02 FLOWAGE	53.6				2.0	11.6	11.4	11.4	13.1	3.2	.9	
03 SITE ACCESS	22.4			12.2	6.9			3.3				
04 SITE CLEARING	2.7			1.1	.6	.4		.1	.1	.2	.2	
05 COFFERDAMS	25.1				6.5	5.9	8.1	4.6				
06 LEFT BANK STABILIZATION	75.5			1.4	27.4	12.1	4.5	16.5	6.4	7.2		
07 DIVERSION TUNNELS	76.3				29.2	30.3	15.1		.6	1.1		
09 EARTHFILL DAM	114.0					14.6	28.4	41.3	25.9	3.8		
10 FOREBAY CHANNEL AND GR. WALLS	56.3					13.5	15.5	13.4	13.9			
11 SPILLWAY	117.7			1.1	8.4	9.9	24.2	41.0	31.6	1.5		
12 POWER INTAKES/PENSTOCKS	113.4			.1	6.0	19.7	32.6	40.0	13.5	1.5		
13 POWERHOUSE CIVIL	117.6			1.1	17.3	11.5	29.5	48.2	6.8	3.2		
14 POWERHOUSE MECHANICAL	84.7				1.0	.3	11.4	18.6	27.5	15.4	9.1	1.4
15 POWERHOUSE ELECTRICAL	105.3						4.8	22.0	34.7	29.0	13.3	1.5
16 SWITCHGEAR BUILDING	46.1						2.9	18.0	19.3	5.3	.6	
17 CONSTRUCTION SERVICES	33.8			11.8	1.7	3.9	10.4	3.0	1.8	1.2		
DIRECT CONSTRUCTION COST	1,079.7	5.9	1.5	32.9	110.2	138.9	203.5	285.4	197.2	74.3	26.3	3.6
18 CONTINGENCIES	141.4		.2	4.9	16.3	20.6	28.9	38.2	22.5	7.3	2.2	.3
19 MITIGATION AND COMPENSATION	24.7			4.1	4.1	5.5	5.5	5.5				

TABLE 2

PEACE SITE C (DEC93 ISD #300)
SUMMARY COST ESTIMATE & DISTRIBUTION OF EXPENDITURES BY FISCAL YEAR
BY PROJECT FEATURE

ORIG ESTIMATE DOLLAR BASE OCT 85
CURRENT PRICE LEVEL DATE OCT 85
ESCALATION FACTOR 1.000
COST IN $ MILLIONS

IDENTIFICATION	TOTAL	PRIOR	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96
INFLATION FACTORS			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
EFFECTIVE INFLATION			1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
****THE FOLLOWING FIGURES ARE NOT INFLATED****												
20 ENGINEERING FNL DSGN + ADMIN	131.8	7.5	7.2	8.8	15.4	17.0	17.7	17.9	16.9	14.4	7.4	1.6
21 HEARING EXPENSES	5.2	4.2	1.0									
22 CONSTR INSURANCE AND BONDS	15.2			2.2	2.4	2.3	2.0	1.6	1.6	1.6	1.5	
23 ENGINEERING STUDIES (PRIOR)	24.5	24.5										
INDIRECT CONSTRUCTION COST	342.8	36.2	8.4	20.0	38.2	45.4	54.1	63.2	41.0	23.3	11.1	1.9
TOTAL PROJECT CONSTRUCTION COST	1,422.5	42.1	9.9	52.9	148.4	184.3	257.6	348.6	238.2	97.6	37.4	5.5
TOTAL DAM & POWERHOUSE CAPITAL COST	1,422.5	42.1	9.9	52.9	148.4	184.3	257.6	348.6	238.2	97.6	37.4	5.5

TABLE 2

±REPORT ID BHA4001000 RUN DATE 1986 OCT 29

PEACE SITE C (DEC93 ISD $300)

ESTIMATING & SCHEDU SUMMARY COST ESTIMATE & DISTRIBUTION OF EXPENDITURES BY FISCAL YEAR PAGE 1

BY SUB-PROJECT

ORIG ESTIMATE DOLLAR BASE OCT 85
CURRENT PRICE LEVEL DATE OCT 85
ESCALATION FACTOR 1.000
COST IN $ MILLIONS

IDENTIFICATION		TOTAL	PRIOR	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96
INFLATION FACTORS				1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
EFFECTIVE INFLATION				1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
****THE FOLLOWING FIGURES ARE NOT INFLATED****													
01 COMMON		1,242.3	42.1	9.9	52.9	147.3	184.3	245.9	311.1	180.9	51.4	14.1	2.4
02 UNIT 1	DEC 93	30.8				1.1		4.9	8.5	11.1	2.4	2.8	
03 UNIT 2	DEC 93	29.8						3.3	9.0	8.9	5.4	3.2	
04 UNIT 3	MAR 94	29.9						1.8	6.5	11.7	6.4	3.5	
05 UNIT 4	JUN 94	29.9						1.2	5.3	10.1	9.8	3.5	
06 UNIT 5	SEP 94	29.9						.5	4.4	8.3	11.7	5.0	
07 UNIT 6	DEC 94	29.9							3.8	7.2	10.5	5.3	3.1
TOTAL PROJECT CONSTRUCTION COSTS		1,422.5	42.1	9.9	52.9	148.4	184.3	257.6	348.6	238.2	97.6	37.4	5.5
TOTAL DAM & POWERHOUSE CAPITAL COST		1,422.5	42.1	9.9	52.9	148.4	184.3	257.6	348.6	238.2	97.6	37.4	5.5

TABLE 3

TABLE 4

500 kV TRANSMISSION LINE DESIGN

1. Towers		
a.	Material	Steel-Galv.
b.	Type (see Figs. 3 and 4)	Self Supporting Guyed Vee
c.	Average Height:	
	i. To Top, (ft)	99
	ii. To Crossarm, (ft)	92
d.	Nominal Ruling Span, (ft)	1250
e.	Maximum Span Length, (ft) (sp. River Crossing)	3600
f.	Minimum Conductor Clearances:	
	i. Insulator Swing Angle, (°)	31°
	ii. Min. Clearance, (ft) 0-5500'	10'-0"
	5500-7000'	10'-7"
	iii. Fixed Clearance, (ft) 0-5500	10'-0"
	iv. To Ground, (ft)	33'
g.	Phase Spacing, (ft)	38'-10", 39'-6"
2. Insulators		
	Suspension Strings:	
a.	Size	5 3/4" x 10"
b.	Type	ball and socket
c.	Strength, (lb)	36,000
d.	Configuration:	
	i. Centre Phase	free swinging
	ii. Outside Phase	free swinging
e.	Number Units	23
f.	Leakage Distance per String, (in)	287.5
g.	Inches Leakage per kV Maximum to Ground	0.9
h.	Grading rings	No
	Strain Assembly	
i.	Size	6 11/16" x 11"
j.	Type	ball and socket
k.	Strength, (lb)	46,000
l.	Number Units	20
m.	Number Strings/Phase	2
n.	Leakage Distance per String, (in)	290
o.	Inches Leakage per kV Maximum to Ground	0.91
p.	Grading rings	Yes
q.	Electrical Strength 1.4 x 50 Impulse, (kV)	1950

TABLE 4 - (Cont'd)

2.	Insulators - (Cont'd)	
r.	Wet Switching Surge, (kV):	
	i. CFO	1120 (Test)
	ii. Withstand 3 Sigma	990 (Test)
s.	60 Hz, Wet, 10 s, RMS kV:	
	i. Flashover	880
	ii. Withstand	780
3.	Conductors	
a.	Conductor:	
	i. Material	ACSR
	ii. Code Name	Peace
	iii. Size MCM	623.8
	iv. Stranding	48/7
	v. Diameter, (in)	0.95
	vi. Number per Phase	4
	vii. Bundle Spacing, (in)	18
	viii. Weight per Foot, (lb)	0.734
	ix. Ultimate Strength, (lb)	19,850
	x. Maximum Design Tension, (lb)	9,925
	xi. Tension, (lb):	
	- @ 60°F	3400
	- @ 120°F	3115
	xii. Sag for Ruling Span, (ft)	
	- @ 60°F	42.5
	- @ 120°F	46.6
b.	Armor Rods	No
c.	Dampers	No
d.	Spacers	With Dampers
e.	Transposition	Yes
4.	Ground Wires	First 5000'
a.	Number	2
b.	Material	Steel
c.	Diameter, (in)	3/8"
d.	Insulated	No
e.	Max. Shielding Angle, (°)	30°
f.	Max. Tower Footing Resistance, (Ω)	20
g.	Tower Grounding Method	Footing
h.	Isokeraunic Level	5-10
i.	Design Lightning Outage Rate, No./100 mi/yr	3

TABLE 4 - (Cont'd)

5. Electrical Characteristics

a.	Equivalent Phase Spacing, GMD, (ft)	49.75
b.	MCM per Phase	2495.2
c.	AC Resistance - Ω/Phase/Mile @ 25°C	0.04
d.	Inductive Reactance (X_1) Ω/Phase/Mile, Positive Sequence	0.5306
e.	Capacitive Reactance (X_c) MΩ/Phase/Mile, Positive Sequence	0.124
f.	Current Carrying Capacity:	
	i. Summer - Amperes/phase	2500
	- Temperature rise	37°C
	ii. Winter - Amperes/phase	3480
	- Temperature rise	57°C
g.	Line Charging, MV·A/Mile $(Emax)^2/X_c$	2.43
h.	Surge Impedance (Z) $\sqrt{X_1 X_c}$, Ω	256
j.	Surge Impedance Loading:	
	i. Zero Comp. $(Emax)^2/Z$, MW	1180
	ii. 50% Compensation, MW	1670

TABLE 5

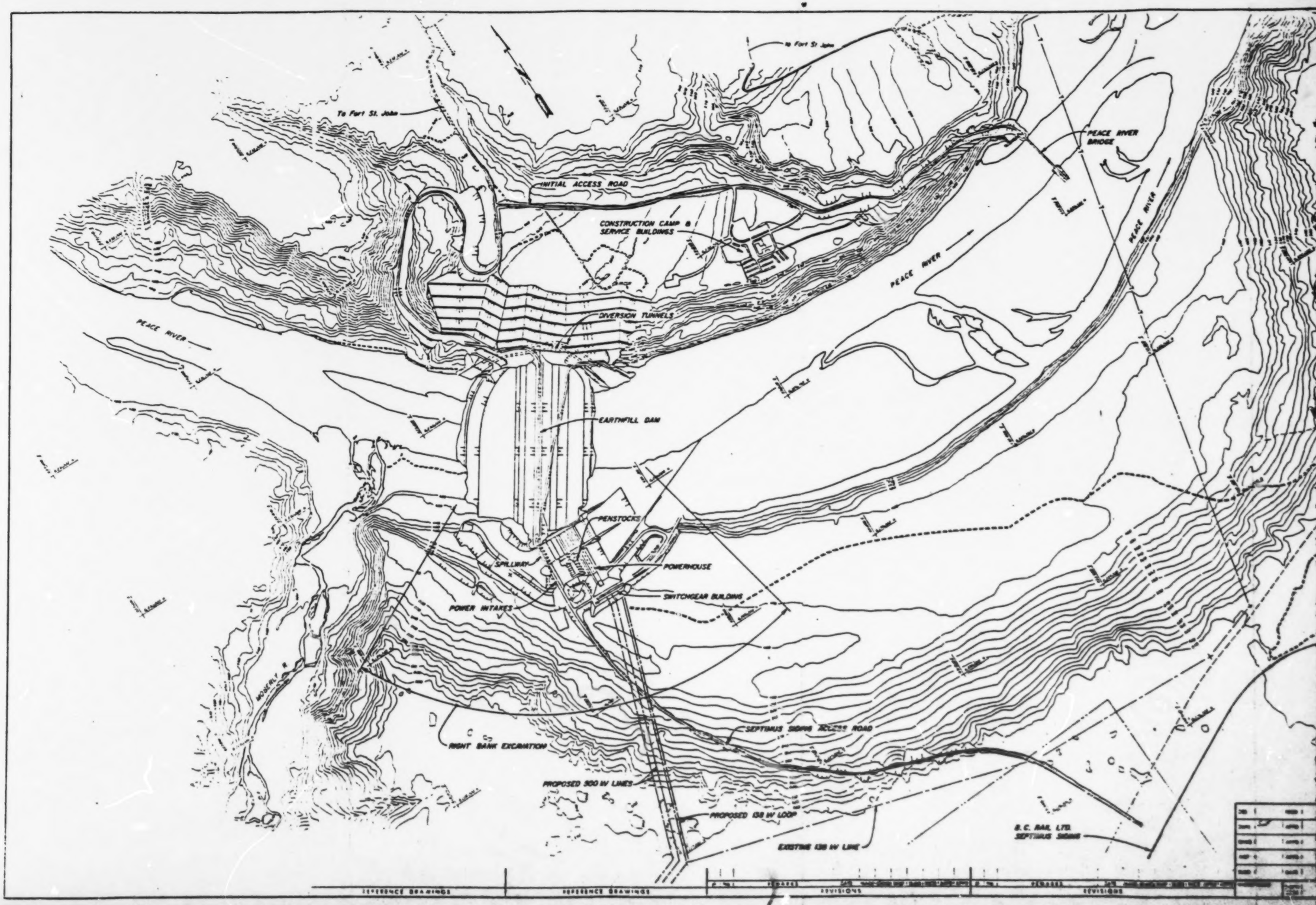
SITE C TRANSMISSION LINE - OVERALL COST SUMMARY
(October 1985)
(Canadian $000s)

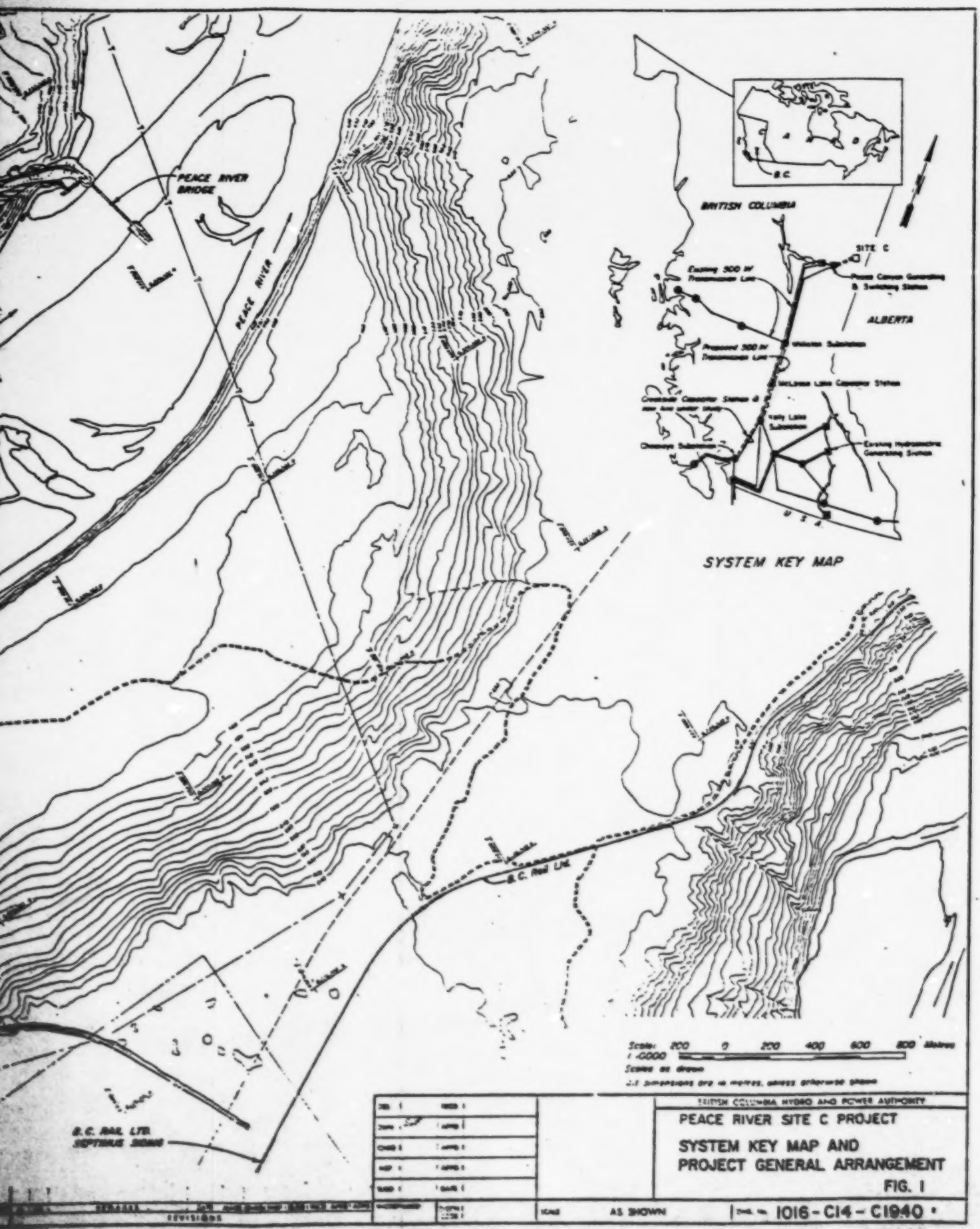
Transmission Line Project	Totals	Prior	1986/87	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1994/95	1995/9
Site C-Peace Canyon	43 169.6	77.0	296.5	912.2	916.2	2004.7	2 950.6	8 142.2	12 800.0	10 960.7	3776.1	410.3
Williston-Kelly Lake	71 271.1	365.0	197.5	555.5	1129.9	1369.5	12 290.9	11 937.4	35 911.4	6 233.6	1336.5	309.0
Kelly Lake-Cheekye	82 910.0	984.0	553.2	1776.3	1976.3	1297.5	21 583.5	25 163.4	22 354.4	5 441.6	1082.2	255.6
Totals	197 350.7	1426.0	1047.2	3244.0	4022.4	4671.7	36 825.0	45 243.0	71 065.8	22 635.9	6194.8	974.9

TABLE 6

PEACE RIVER SITE C PROJECT
STATIONS
EXPENDITURES BY FISCAL YEAR
(October 1985)
(Canadian $000s)

	Year						
Station	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	Total
Cheekye			20	14	959	548	1 541
Creekside Cap.	30	102	617	564	5 889	1037	8 239
Kelly Lake			36	703	7 999	3419	12 157
McLeese Cap.	32	110	631	482	8 378	1292	10 925
Williston			24	124	3 483	2898	6 529
Peace Canyon G.S.	—	124	1244	3228	8 031	94	12 721
Total	62	336	2572	5115	34 739	9288	52 112


To Fort St. John
INITIAL ACCESS ROAD
CONSTRUCTION CAMP & SERVICE BUILDINGS
DIVERSION TUNNELS
EARTHFILL DAM
PENSTOCKS
SPILLWAY
POWERHOUSE
SWITCHGEAR BUILDING
POWER INTAKES
RIGHT BANK EXCAVATION
PROPOSED 500 kV LINES
PROPOSED 138 kV LOOP
EXISTING 138 kV LINE
SEPTIMUS SIGMA ACCESS ROAD
B.C. RAIL LTD. SEPTIMUS SIGMA
PEACE RIVER BRIDGE
PEACE RIVER
REFERENCE DRAWINGS
REFERENCE DRAWINGS
REVISIONS
REVISIONS


PEACE RIVER BRIDGE
PEACE RIVER
B.C. RAIL LTD.
B.C. Rail Line
BRITISH COLUMBIA
ALBERTA
SITE C
Existing 500 kV Transmission Line
Proposed 500 kV Transmission Line
Peace Canyon Generating & Switching Station
Williston Substation
McNaughton Lake Compensation Station
Chetwynd Compensation Station & new and upper limits
Gordon M. Shrum Generating Station
Dinosaur Lake Substation
Chetwynd Substation
Existing Hydroelectric Generating Station
U.S.A.
SYSTEM KEY MAP
Scale: 1:40000
200 0 200 400 600 800 Metres
Scales as drawn
All dimensions are in metres, unless otherwise shown
B.C. RAIL LTD. SKEENA SIDING
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY
PEACE RIVER SITE C PROJECT
SYSTEM KEY MAP AND PROJECT GENERAL ARRANGEMENT
FIG. 1
DESIGNED
DRAWN
CHKD
AUTH
TRACED
CHECKED
SCALE AS SHOWN
DWG. No. 1016-C14-C1940
REVISIONS

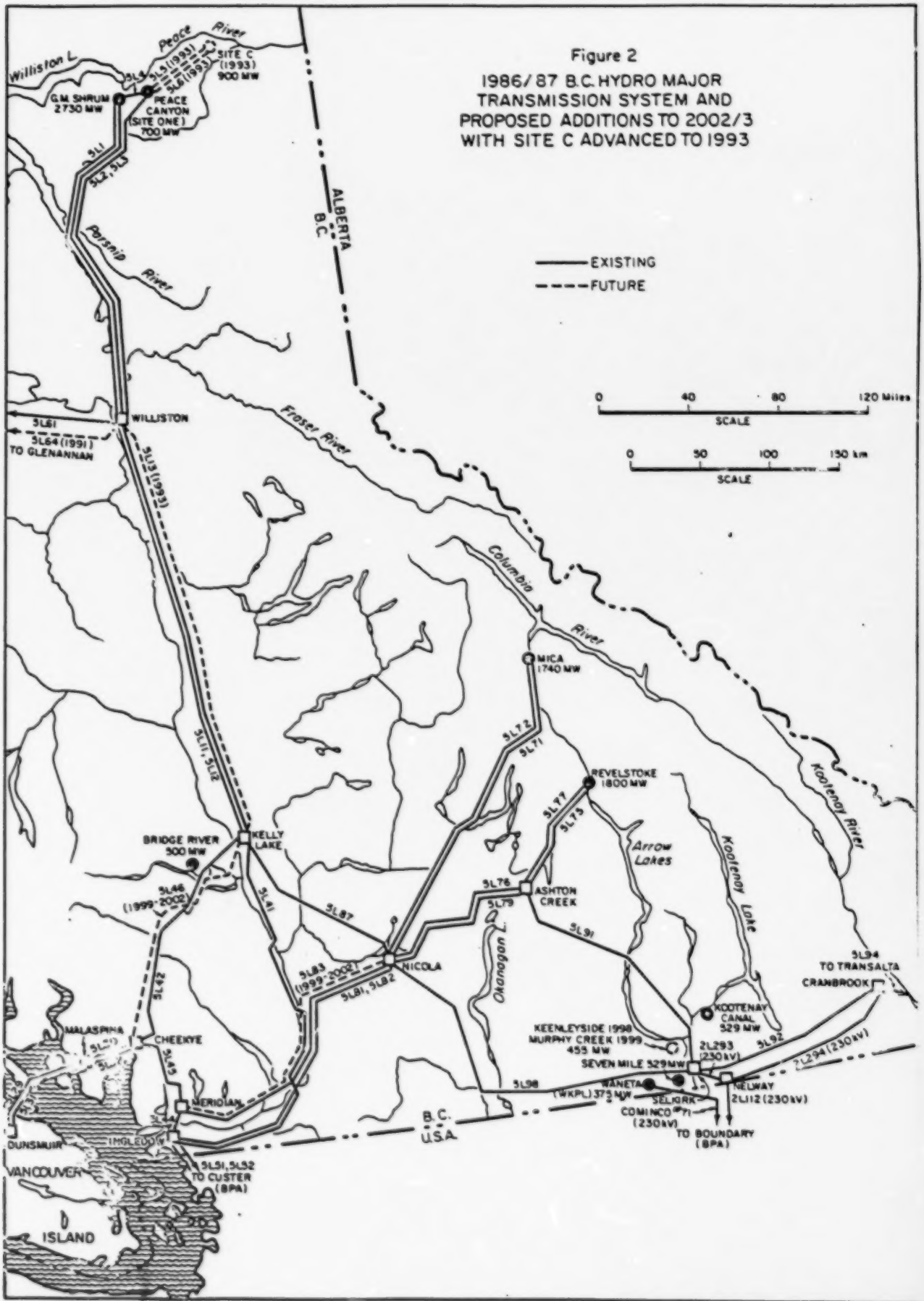


Figure 2
1986/87 B.C. HYDRO MAJOR TRANSMISSION SYSTEM AND PROPOSED ADDITIONS TO 2002/3 WITH SITE C ADVANCED TO 1993
EXISTING
FUTURE
0 40 80 120 Miles
SCALE
0 50 100 150 km
SCALE
Peace River
Williston L.
G.M. SHRUM 2730 MW
PEACE CANYON (SITE ONE) 700 MW
SITE C (1993) 900 MW
3L1
3L2, 3L3
3L4
3L5 (1993)
3L6 (1993)
Parsnip River
ALBERTA
B.C.
Fraser River
WILLISTON
3L61
3L64 (1991)
TO GLENANNAN
3L15 (1993)
3L11, 3L12
BRIDGE RIVER 500 MW
KELLY LAKE
3L46 (1999-2002)
3L41
3L87
3L42
3L43
3L83 (1999-2002)
3L81, 3L82
NICOLA
MALASPINA
CHEEKYE
MERIDIAN
DUNSMUIR
IMOLEUM
VANCOUVER
ISLAND
3L51, 3L52 TO CUSTER (BPA)
B.C.
U.S.A.
Columbia River
MICA 1740 MW
3L72
3L71
REVELSTOKE 1800 MW
3L77
3L73
Arrow Lakes
Kootenay River
3L76
3L79
ASHTON CREEK
Okanagan L.
3L91
Kootenay Lake
3L94 TO TRANSALTA
CRANBROOK
KOOTENAY CANAL 529 MW
KEENLEYSIDE 1998
MURPHY CREEK 1999
455 MW
SEVEN MILE 529 MW
2L293 (230 kV)
3L92
2L294 (230 kV)
3L98
WANETA (WKPL) 375 MW
SELKIRK
COMINCO (230 kV)
NELWAY
2L112 (230 kV)
TO BOUNDARY (BPA)

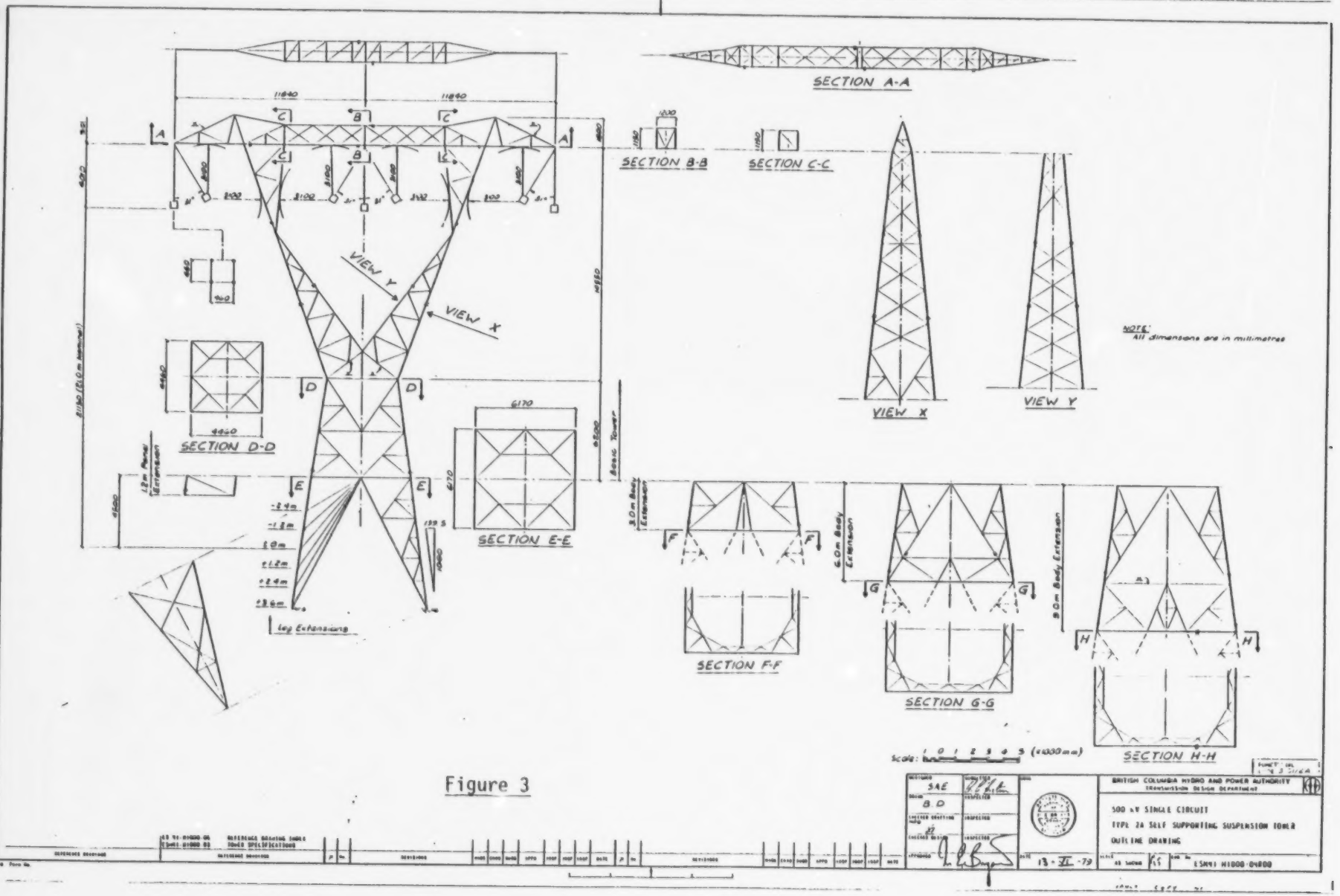

SECTION A-A
SECTION B-B
SECTION C-C
VIEW X
VIEW Y
SECTION D-D
SECTION E-E
SECTION F-F
SECTION G-G
SECTION H-H
Base Tower
3.0m Panel Extension
3.0m Body Extension
6.0m Body Extension
9.0m Body Extension
Leg Extensions
NOTE: All dimensions are in millimetres
Scale: 1 0 1 2 3 4 5 (=1000mm)
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY
TRANSMISSION DESIGN DEPARTMENT
500 kV SINGLE CIRCUIT
TYPE 2A SELF SUPPORTING SUSPENSION TOWER
OUTLINE DRAWING
SAE
B.D
13-VI-79
ESM91 H1000-04800

Figure 3

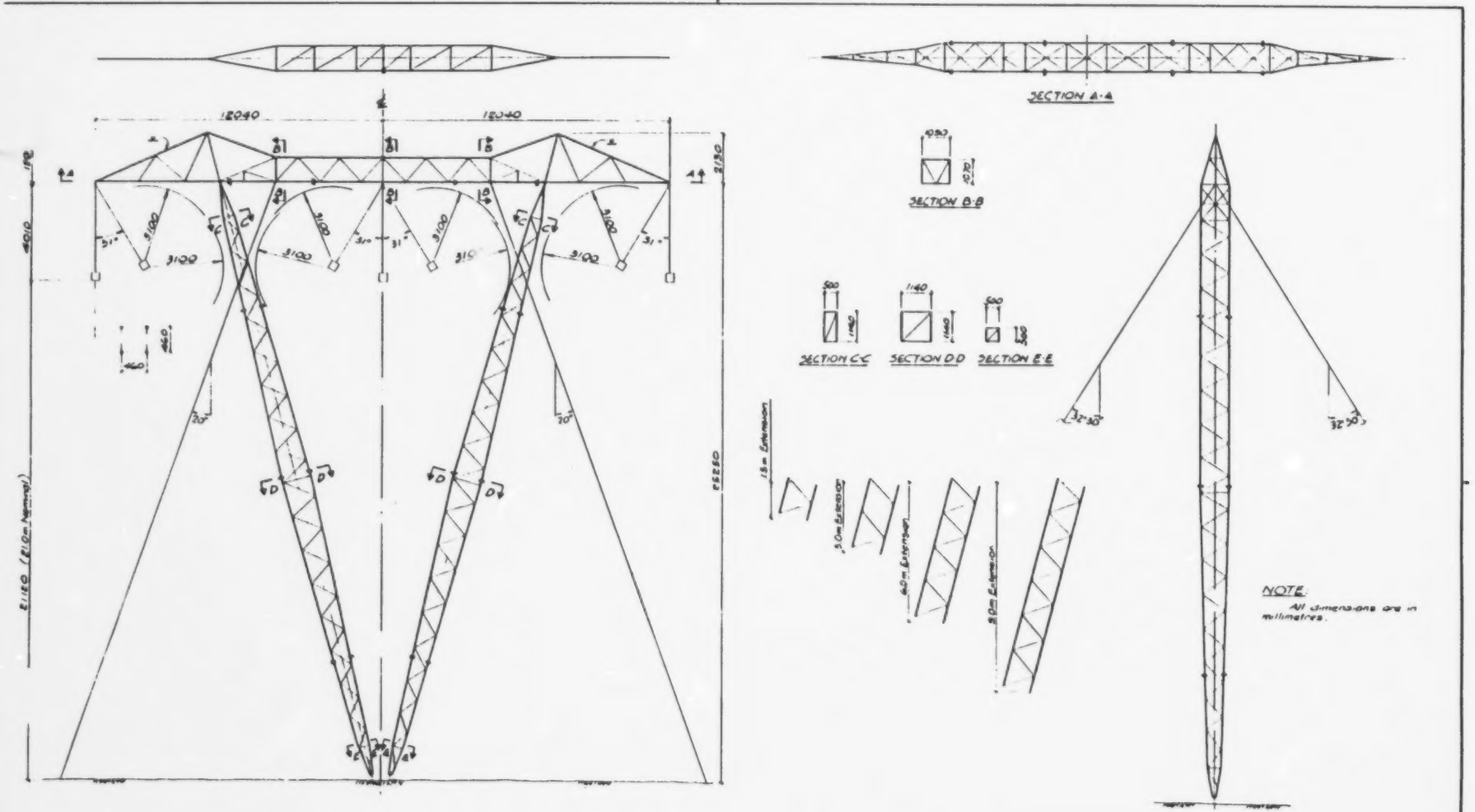
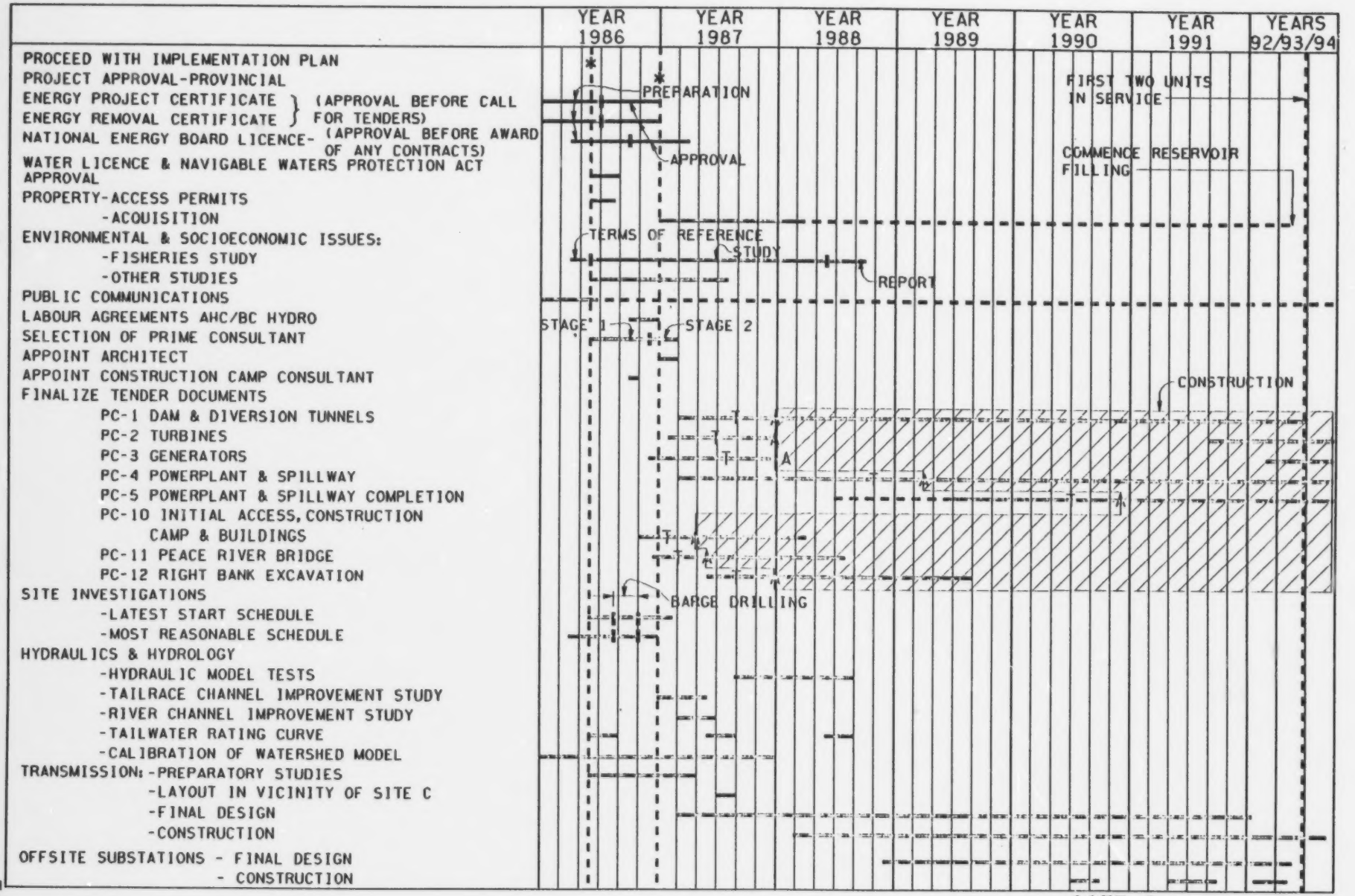

12040
12040
3100
3100
3100
3100
3100
3100
460
460
20°
20°
SECTION A-A
SECTION B-B
SECTION CC
SECTION DD
SECTION EE
1.5m Extension
3.0m Extension
6.0m Extension
9.0m Extension
32°30'
32°30'
NOTE
All dimensions are in millimetres.
Scale
SAE
BRITISH COLUMBIA HYDRO AND POWER AUTHORITY
Transmission Design Department
500 kV SINGLE CIRCUIT
TYPE 2A GUYED SUSPENSION TOWER
OUTLINE DRAWING
13-XI-79
ESAV1-H1001 04800

Figure 4

CAB No. 054(22,2 1PCE6 .DGN; 1
LEVELS=1,2,3,4,5,6



L E G E N D :

T - TENDER ISSUE

A - AWARD OF CONTRACT

SITE C
IMPLEMENTATION PLAN
GENERAL SCHEDULE

FIG. 5

D. REPORT OF TASK GROUP #1A
PROJECT REVIEW

Although a system sale concept is anticipated for the Peace Site C there remains a possibility that negotiations could lead to some other contract arrangement. Therefore, the Technical Working Group expressed a desire to have an independent review of the basic design, assumptions, cost and schedule to define associated risks.

The Task Group #1A was formed with representation from Pacific Power and Light Company, Pacific Gas and Electric Company and Southern California Edison Company. This Task Group was chaired by R.L. Maurel, Southern California Edison Co. This group visited the Peace Site C site, reviewed B.C. Hydro's engineering studies and reference data (including scope, cost and schedule) and prepared a final report for the Technical Working Group.

The final report is attached.

PEACE RIVER SITE "C"

PROJECT REVIEW

TASK 1A

EXECUTIVE SUMMARY

At the request of the Technical Committee, a subtask group was formed to investigate the basic design, assumptions, cost and schedule of the Peace River Project "C" in an effort to define associated risks.

The subtask group consisted of engineers and geologists from Pacific Power and Light Company, the Southern California Edison Company and the Pacific Gas and Electric Company. The subtask group visited the project site and interviewed key B.C. Hydro staff responsible for project design and cost.

The engineering effort on the part of B.C. Hydro is of a high standard of quality. B.C. Hydro utilized the services of outside consultants to supplement their own expertise. In addition, B. C. Hydro employed the assistance of a qualified Advisory Board to review and advise concerning project investigations, design assumptions, and features.

In summary, it is the opinion of the subtask group that the project appears to be technically feasible, can be built in the construction period of 6 1/2 years and at the defined cost plus or minus 10%. To this 6 1/2 years must be added a "zero" year or years which are necessary to complete further technical investigations, obtain permits and/or licenses, and perform remaining studies. Unless year "zero" can be shortened and/or the construction period compressed, the first two units will probably not be available for commercial service until the Fall of 1994. The review of available data, discussions with B.C. Hydro staff and field inspection did not uncover a condition that might be considered to be a fatal flaw.

Although there may be unforseen circumstances that may impact the technical feasibility, cost and schedule, based on review of data summaries and reports, the project appears feasible. However, a more detailed evaluation will be required should the output and total cost of the Site C Project become the sole basis for a power purchase agreement.

II. PROJECT ELEMENT AND KEY SUBJECT AREAS

Based upon visual inspection of the proposed site, review of engineering documentation and discussion with key B.C. Hydro personnel. The following conclusions were formulated by the Subtask Group:

1. Hydrology/Power Study

The units at Site "C" were sized for a capacity factor (55%) which is similar to the upstream plants. The water supply to the project is based upon forty years of record (1940-1980) which adds credibility to the operations study. There is no certainty that this forty year period is representative of the long term water supply for the river but it is evidently the best data available.

The coordination with upstream plants and the large storage at Williston Reservoir will limit generation losses due to spills. Tight control of the Site "C" reservoir elevation fluctuations to maintain head, prevent backwatering of the Peace Canyon Units and coordinate interplant flows, allows for a relative simple and straight forward operations study. The methodology used for the study is standard and it is concluded the results in both capacity and energy production are reasonable.

2. Hydraulics

The large storage at Williston Lake Reservoir tempers the river flows at Site "C".

A. Design flood (project flood)

B.C. Hydro chose the project flood as 60% of the PMF inflow or the 1,000 year flood, whichever is greater. The 1,000 year approach gave the larger peak flow at 420,000 cfs. This flood would pass through the spillway with 20 feet of freeboard on the dam.

B. Probable Maximum Flood

B.C. Hydro's 1977 PMF study determined a peak inflow of 643,000 cfs and a peak outflow of 586,000 cfs. This flow could be passed safely through the spillway with a freeboard of 9.84 feet.

C. Spillway Capacity

The spillway and stilling basin were designed for the project flood of 420,000 cfs assuming that 381,000 cfs was handled by the spill gates and three units were operating at 39,000 cfs.

PMF studies included the McGregor River Diversion which, according to B.C. Hydro, will probably not be built in the foreseeable future. A review of hydrology is underway which may allow for a smaller spillway at Site "C".

3. Earthfill Dam

Most of the construction materials will come from project excavations. The core trench will extend below weak bedding planes and is very wide. Some grouting of the foundation is planned.

Strength values used in the dam design are based on many laboratory tests and seem conservative.

The analysis was done using the simplified Bishop Method for the following criteria:

LOADING	MIN. ALLOWABLE FACTOR OF SAFETY
Normal Storage	1.5
PMF	1.5
Normal Storage + Seismic (0.05g)	1.0

Analysis results exceeded allowables for all cases. Minimum factors of safety occurred for failure surfaces which extend into the weak bedding planes in the foundation.

The seismic loading case gave the lowest calculated factors of safety which were 1.3 upstream and 1.2 downstream.

By incorporating the cofferdams into the final cross-section, the dam is quite conservatively designed. The base width is very long for seepage control. The cofferdam fills provide buttressing for slope stability. While the seismic coefficient (0.05g) for design is very low, the dam, as designed, could probably withstand a much larger event.

4. Concrete Structures

The concrete dam transition, power intakes and spillway headworks have been located to avoid poorer foundation materials and to minimize concrete volumes.

Structures were analyzed assuming a weak bedding plain in the foundation. Ice loading was included in the analysis.

Aggregates will come from a borrow area downstream of the right abutment.

In order to avoid potential problems of sulfide attack on the concrete by foundation materials, 1-2 meters of low water concrete will be placed on the foundation.

5. Diversion Tunnels and Cofferdams

The diversion tunnels and cofferdams were designed to protect the construction for a storm with a 1/25 year return period. The capacity of the diversion tunnels is 120,000 ft^3/sec. With the river control provided by the upstream reservoirs, the design storm seems adequately conservative.

One tunnel will be gated for making downstream releases during construction, but will be plugged after construction. There is no need to keep this tunnel and gate as a low level outlet since the penstocks will be able to drain the reservoir to the top of the upstream cofferdam fill (Elev. 432).

6. Geotechnical Exploration

A review was made of available geotechnical related information regarding the proposed Peace River Site "C" Hydroelectric Project and a site visit was made August 27, 1986. Discussions regarding the geotechnical aspects of the Project were held August 27 and 28 in the Field and the Vancouver office with representatives of B.C. Hydro's technical staff.

General

Taken as a whole, it is concluded that the geotechnical reviews of the Site C Project have been carefully planned and executed by the B.C. Hydro Staff during the reference period 1978-1983. Geotechnical conclusions, as they have influenced the design and planned procedures and practices

for construction of the dam and its appurtenances, have been well conceived. Not only does the B.C. Hydro technical staff enjoy an enviable reputation for their hydroelectric-related work but an external system of checking was instituted through the utilization of (1) consulting technical specialists for such items as seismicity and seismic risk analysis; foundation strength properties determinations; shale properties; concrete aggregate suitability; shoreline stability assessment; etc., and (2) an independent Advisory Board of recognized outside experts.

In summary, we share the opinion of the Advisory Board that ... the ... "geologic and geotechnical investigations for Site C have been extensive and thorough and are appropriate for water retention structures founded on this shale formation ... "Rock defects have been identified and carefully assessed (and) the recommended values for ... rock strength parameters (are) adequately conservative for use in design of the structure foundations and excavated slopes".

Specific comments regarding selected phases or portions of the geotechnical aspects as they relate in a practical sense to the Project design and construction (and in which we concur with the Advisory Board) are noted briefly as follows:

A. Foundation and Abutments

The physical and both laboratory-determined and in-situ strength properties of the shale bedrock constituting the foundation and abutments are well understood. The rock defects therein, consisting principally of Peace River Valley stress relief features (joints, shears, and thrust faults) have been identified and the assignment of rock strength parameters are adequately conservative for use in the design of the structure foundations and excavated slopes. The relatively rapid slaking characteristics of the shale are recognized and appropriate construction measures are proposed.

B. Shoreline Stability

It is recognized there is a history of slope instability as observed by movement of the Peace River and Moberly River Valley slopes upstream from Site C ..." and that some of the valley slopes have the potential for producing a large slide during the life of the reservoir". However, it has been concluded (again, by the Advisory Board) that (1) known large slides (such as the Attachie) are too far removed from the damsite to be of concern regarding danger of over-topping by slide-induced waves, (2) readjustments of bedrock slopes can occur in response to saturation by increased water levels, and (3) a rapid slide in the flat lying shales is highly unlikely.

All investigators, and reviewers conclude, as we do, that adequate funds be allocated in the pre- and post-operational budgets to cover the cost of a comprehensive program of slope monitoring within the reservoir perimeter. Possible mitigation measures at Attachie and Bear Flat may need to be included for developments to be protected from slide-induced waves.

C. Quarry and Borrow Areas

It was reported in B.C. Hydro Report No. 869 (December 1978) that construction materials from the project excavation are considered suitable to provide approximately 90% of the volume of embankment fill for the dam and cofferdam and that adequate reserves of granular sand and gravel and impervious silt and clayey silt are within about 2 miles of the damsite. It was noted that the only major deficiency is the lack of high quality rip-rap and rock fill close to the damsite. As part of Item 6-D, below, further investigation are proposed to locate (1) an alternative source of suitable core material, and (2) available, durable rip-rap other than that available from the Peace Canyon-Hudson Hope area (80 km)

or Chetwynd (140 km). It was later reported in B.C. Hydro Report No. H1358 (May 1981) that ..."in the general vicinity of the site, more than adequate quantities of granular materials were available for shell, filter, and drain zones of the dam and concrete aggregates".

D. Remaining Work

As noted in B.C. Hydro Report No. H1523, June 1982, additional geological investigations are recommended to include:

(1) Drilling for the foundation of the temporary bridge to be constructed downstream from the site;

(2) Drilling to determine the nature of the riverbed shear where it intersects the bedrock surface beneath the downstream shell;

(3) Fill-in drilling in the spillway area to determine rock quality and the location of any shears;

(4) Pump tests in the right bank alluvium to determine if the slurry trench cutoff is needed for the first stage cofferdam in this area;

(5) Drilling and trenching to investigate the stratigraphic trough on the left bank;

(6) Additional construction materials investigations; and

(7) Additional monitoring at Attachie Slide

In order to fill in the gaps to complete the understanding of all aspects of the site geology, we concur with the additional investigations proposal, particularly in regard to Items (2) and (5) which relate to resolving questions concerning stratigraphy and structure at the damsite, important to design considerations.

7. Ice Regime

The impact of ice formation on the project has been studied both for the construction period and after completion of the project. After completion of the project a partial ice cover would form during the winter on the reservoir starting at the shoreline and gradually developing toward the middle. In most years the reservoir would be largely ice covered by mid-winter. The daily reservoir fluctuations would fracture the ice cover near the shoreline and develop locally thick ice cover in the fracture zone. Open water conditions would result at the upstream end of the reservoir near the discharge of Peace Canyon Powerhouse and near the downstream end at the Site C intake. Because the flow into the Site C powerhouse intake is relatively warm water discharged from the WAC Bennett dam, and because of the relative depth of the Site C Powerhouse intake, no icing conditions are anticipated that would adversely impact the power operation.

Ice formation in the river downstream of the project would continue in a similar manner as the present; however, the open water would extend further downstream than it would without the dam.

During the construction period ice generated upstream would be diverted through the open channel between the Stage I diversion coffer dams and through the 36.7-foot-diameter diversion tunnels after completion of the Stage II coffer dam. All ice formed upstream would accumulate and build up a cover upstream of the coffer dam. When the discharge is reduced the ice cover would breakup and be transported through the tunnels. Sudden collapses of the temporary ice cover would cause surges in the water level but there would not be any overtopping of the coffer dam.

8. Seismic Studies

The following reports that address seismicity for the Peace River Site C project were reviewed:

- Report on Seismicity Review - Site C (Klohn-Leonoff)
- Memorandum on Seismicity (B. C. Hydro)
- Seismic Risk Analysis (Housner)

In general, the tectonics and seismicity discussions are reasonably thorough. The seismogenic zones selected for use in the probabilistic risk analysis appear reasonable, as they are based on regional geology and seismicity. The Housner report, although brief, emphasized important points in the ground motion selection and characterization.

Two areas appeared to be given insufficient treatment in the development of inputs to the hazard analysis:

1. A thorough investigation of local recent faulting should be accomplished using aerial photography, detailed ground checking and other state-of-the-art techniques as appropriate. This effort might be done as a confirmatory study rather than a design study, but a careful assessment should be documented to avoid possible future issues related to fault activity at close distance to the dam site.

2. The topic of reservoir-triggered seismicity was briefly addressed and then discounted. To the contrary, the possibility of earthquakes of moderate size (magnitude 5 to 5 1/2) could be postulated and statistically predicted to occur close to the dam site. Housner recommended evaluation of the dam design for such-sized events to accommodate this possibility. The issue of triggered seismicity may be less critical to the actual safety of the dam than to perceptions of safety by local residents and

governmental officials. Such a study could be accomplished in a confirmatory fashion in conjunction with the evaluation of the presence of recent faulting.

A review should be made of seismicity considering earthquakes that have occurred within the area since the reports were prepared.

9. Environmental Studies

The Site C report and recommendations to the Lieutenant Governor-In-Council dated May 1983 is comprehensive in coverage of environmental issues. It appears from this document that all potential impacted areas are addressed. Many mitigation costs have been determined by the British Columbia Utilities Commission and B.C. Hydro has been directed to study several others, including fishery impacts. It is understood that fish studies would be undertaken on recommencement of site investigations. The risk of major costs for dam bypass facilities and other related mitigation expenses are low since The Peace River is not considered to have an anadromous fishery.

Transmission right-of-way impacts and mitigation requirements have not been fully determined.

10. Transmission

The requirements to bring the project output to the U.S./Canadian border have been determined in sufficient detail to estimate the cost. B.C. Hydro has identified losses in energy and capacity to deliver the project output to the border. The loss in capacity from 900 to 805 (11%) appears high but is based on peak load conditions within the Canadian System. Extensive work is involved in switchyards and transmission line segments between switchyards. The proposed new transmission lines in most cases will parallel existing circuits. B.C. Hydro experience with outage frequencies in this, at times, harsh climate are representative of what

might be expected of the new circuits. The frequency of power flow interruption is expected to be low, due to past experience and therefore, is not considered to be of a high risk nature.

11. Licensing and Permits

An Energy Project Certificate must be otained. Under the Utilities Commission Act, a Certificate of Convenience and Necessity is deemed to have been issued by the issuance of an Energy Project Certificate. Prior to construction, B.C. Hydro must obtain approvals under The Water Act and The Waste Management Act. The British Columbia Utilities Commission, in the May 1983 Site C Report, recommended that at such time as an Energy Project Certificate is issued, the Cabinet take whatever steps are required under the Agricultural Land Commission Act to allow the project to proceed.

Federal Government approval is required under the Navigable Waters Protection Act.

In addition, an energy export license will be required. The prospects for such a license are high as reflected by practices in eastern provinces.

12. Costs Estimates

A preliminary review of the estimate for development of the Peace River Site C Hydroelectric Project was made. In conducting the review the following evaluation was made with the indicated results.

A. Individual unit prices used in the estimate were converted to a "standard" price based upon present currency exchange rates, area adjustment factors and metric to English conversions and compared to published standard estimating rates for the type of work. The results show that the Site C estimated rates compare well with the standard published rates. Although there are some variations, the Site C estimate appears on the conservative side. This is particularly true for the embankment prices.

B. The total estimated cost of the civil, mechanical, and electrical components of the powerhouse and switchgear buildings were compared with rule of thumb costs developed by the U.S. Corps of Engineers for estimating hydro projects. The Site C estimate is again conservative and appears to be 10 percent higher than the USCE rule of thumb estimate.

C. The totals for civil, mechanical, and electrical and the indirects as a percentage of total costs were compared to the expected range for these costs as computed by Noyes Data Corporation adjusted to exclude interest. The results indicate the civil related costs compose a higher than expected, and the mechanical/electrical components compose a lower than expected percentage of the total project costs.

D. The contingencies allowance of 10 percent for the civil costs appears low in view of the expected foundation conditions. However, this is balanced by what appears to be a conservative total cost estimate.

Table 1 represents the estimated cost to construct the Site C Hydroelectric Project. The cost to finance the construction of Site C is dependent, in part, upon the following factors: type of financing (taxable, tax exempt, equity, debt or any combination thereof), security (guarantor of financing), repayment period, interest payments due during the construction period, financing interest rate, reinvestment rate during construction period, total amount to finance and future economic conditions at the time of financing. These factors are beyond the scope of the Technical Working Group. Therefore, the Technical Working Group recommends that the cost to finance the construction of Site C be estimated by underwriters familiar with project financing.

The Technical Working Group believes that it would be a grave error for the reader to convert the estimated cost to construct Site C into an equivalent power purchase rate because the conversion excludes financing costs which are expected to be a major element of the cost to purchase Site C power. Long construction period hydroelectric projects have had financing costs in amount approximately equal to the constuction cost. Since the power purchase rate will be dependent upon the financing cost, it is inappropiate to determine a power purchase rate until after such a cost is estimated.

III. Risk Analysis

A detailed risk analysis is not possible in the short time available. The following is a general approach to specific areas that appeared to the task group to deserve the greatest attention.

Subject	Risk
Hydrology	Low
Hydraulics (spillway design flood and PMF)	Low
Earth Fill Dam	Moderate*
Concrete Structure	Low
Diversion Tunnels	Low*
Foundation	Moderate*
Abutments	Moderate*
Shoreline Stability	Moderate
Ice Regime	Low
Seismic	Low
Environmental Study	Low
Transmission	Low
Licensing	Low
Costs	Low

*Recommended additional geotechnical exploration will provide information to lower risk in these areas.

IV. Conclusions

The British Columbia Utilities Commission, in their Site C Report dated May 1983, stated (Page 137) that "The commission concludes that Hydro is thoroughly experienced in managing the design and construction of hydroelectric projects and will be able to carry Site C forward to a timely conclusion".

Based upon the Subtask Groups site visit, discussions with B.C. Hydro staff and review of studies, consultant reports and other documents, the task group agrees with the Utilities Commission.

1. Peace River Site C appears to be a viable hydro project.

2. Cost estimates, plus or minus 10% are reasonable for the level of engineering detail provided assuming cost of capital and escalation rates remain stable.

3. The engineering work is of sufficient detail and appears to be accurate.

4. A 6 1/2 year construction period is practical.

5. There are no apparent "fatal flaws".

Respectfully Submitted,

Stanley A. deSousa
Pacific Power and Light

James C. Gamble

Wayne D. Edwards
Pacific Gas and Electric

Phil J. West

Ronald L. Maurel
Southern California Edison

RLM:8925w

Table 1

PEACE RIVER SITE C HYDROELECTRIC PROJECT
-- MAJOR ASSUMPTIONS AND COST ESTIMATES --
(As provided by British Hydro)

ASSUMPTIONS

NAMEPLATE SIZE:	900 MW
CAPACITY FACTOR:	60%
ENERGY DELIVERED: (TO THE CANADIAN BORDER)	4,220 GWH
INFLATION RATE:	5.5%
ECONOMIC LIFE:	70 YEARS

PEACE RIVER SITE C DIRECT CONSTRUCTION EXPENDITURES
(MILLIONS OF DOLLARS)

YEAR	Prior	0/1	1/2	2/3	3/4	4/5	5/6	6/7	7/8	8/9	9/10
(IN CANADIAN 1985 UNINFLATED $)											
GENERATION	42.1	9.9	52.9	148.4	184.3	257.6	348.6	238.2	97.6	37.4	5.5
TRANSMISSION \1	1.4	1.0	3.3	4.1	5.0	39.4	50.4	105.8	31.9	6.2	1.0
TOTAL	43.5	10.9	56.2	152.5	189.3	297.0	399.0	344.0	129.5	43.6	6.5
CUMM. TOTAL	43.5	54.4	110.6	263.1	452.4	749.4	1148.4	1492.4	1621.9	1665.5	1672.0
(IN CANADIAN INFLATED $) \2											
GENERATION	42.1	10.4	58.9	174.3	228.3	336.7	480.7	346.5	149.8	60.6	9.4
TRANSMISSION \1	1.4	1.1	3.7	4.8	6.2	51.5	69.5	153.9	49.0	10.0	1.7
TOTAL	43.5	11.5	62.6	179.1	234.5	388.2	550.2	500.4	198.7	70.6	11.1
CUMM. TOTAL	43.5	55.0	117.6	296.6	531.1	919.3	1469.5	1969.9	2168.6	2239.2	2250.3

\1 Includes substations.
\2 Assumes inflation rate of 5.5%.

E. REPORT OF TASK GROUP #2
TRANSMISSION IN CALIFORNIA

The California Transmission Task Group consisted of representation from the four California utilities on the Technical Working Group. The Task Group was chaired by Cliff Young, Pacific Gas and Electric Company.

The mission of this Task Group was to determine whether transmission facilities already planned for operation in California by 1993 can accommodate the share of Site C power requested by the California participants.

The attached letter dated 5 November 1986, together with a one page report, provides the final report of this Task Group.

PACIFIC GAS AND ELECTRIC COMPANY

PG&E + 77 BEALE STREET . SAN FRANCISCO, CALIFORNIA 94106 . (415)781-4211 . TWX 910-372-6587

November 5, 1986

Mr. D. G. McFarlane, Manager
System Engineering Division
B. C. Hydro

Subject: Task Group #2--Transmission in California

Attached is the report of the Task Group concerning the ability of existing and planned transmission to accommodate the California utilities' requested shares of Site C capacity and energy.

Sincerely,

Clifford C. Young

SITE C PROJECT--CALIFORNIA TRANMISSION TASK GROUP

At the October 1, 1986 meeting of the Technical Working Group, the Chairman of the Task Group #4--Market in California presented a summary of the market responses from California utilites. The survey shows that the allocation for California is oversubscribed in all seasons.

Although the final allocation might be different, the California Tranmission Task Group was directed (1) to assume that each of the California utilities received its requested amount of capacity and energy and (2) to determine on that basis whether the utilites would have sufficient transmission capability to that accept that amount.

It is assumed that the following facilities will be in operation by 1993 to accommodate the California participant's share of Site C generation:

(1) AC Pacific Intertie rated at 3200 MW (measured at Malin Substation)

(2) DC Pacific Intertie rated at 3100 MW (measured at Celilo Substation)

(3) COT Project rated at 1600 MW (measured at a southern Oregon substation)

The California participants (Los Angeles Department of Water and Power, Pacific Gas and Electric Co., San Diego Gas & Electric Co., and Southern California Edison Co.) have affirmed that their entitlements in the above listed projects are adequate to accommodate their requests for Site C capacity and energy.

F. REPORT OF TASK GROUP #3
NORTHWEST TRANSMISSION

The Northwest Transmission Task Group consisted of members from Pacific Power and Light Co., Portland General Electric Co., Puget Sound Power and Light Co., The Washington Water Power Co., the Public Generating Pool and Bonneville Power Administration. The Task Group was chaired by Rich Bayless from Pacific Power and Light Co.

The mission of this Task Group was to report on the adequacy of the existing and planned transmission in the Northwest to deliver Site C project associated energy and capacity from the Canadian border to and through the Northwest; and to identify additional facilities in the Northwest if any are required.

The initial terms of reference for this study were:

(1) Identification of the firm and non-firm transfer capacities of the planned system to deliver Canadian power from the Canadian/USA border connections under worst case assumptions to:

- Loads in the Northwest only.

- Loads outside of the Southern and Eastern borders of the Northwest region.

Bottlenecks were identified.

(2) A determination was made of new facilities required to add an additional 805 MW firm to the transfer from Canada identified above. The report identifies the required facilities, rough costs and approximate construction schedules.

(3) Approximate average and incremental losses for the Northwest Transmission were determined.

The study identifies transmission requirements to transfer Site C power to Northwest customers and to the California/Oregon border. It does not address BPA Long Term Intertie Access Policy or contract paths.

The final report is attached.

11/4/86

CANADIAN SITE "C" PROJECT
TASK GROUP #3
NORTHWEST TRANSMISSION
Report on Initial Investigations

EXECUTIVE SUMMARY

INTRODUCTION:

This report summarizes preliminary technical investigations into the adequacy of the U.S. Northwest transmission system to deliver an 805 MW firm import associated with the Site "C" project development in 1994 to the U.S.

The level of detail investigated in these studies is only to the extent to provide Site "C" signatories with enough data regarding U.S. Northwest transmission to proceed past the feasibility stage and onto the next phase of the Project.

CONCLUSIONS:

For the 1994 system, there appear to be no major technical or environmental obstacles associated with transmission which would be showstoppers to the delivery of firm Canadian power to or through the Northwest at the transfer levels described below.

The 1994 U.S. system, as planned, is capable of delivering 1200 MW firm/2000 MW non-firm from the Canada/U.S. border. Expenditures of approximately $15M (1986, U.S.) will be required to upgrade the U.S. system to enable delivery of 2000 MW firm/3000 MW non-firm from the Canada/U.S. border.

If deliveries are to the East or within the Northwest, as opposed to deliveries through the Northwest to California the $15M expenditures may be reduced by $3M.

MAJOR ASSUMPTIONS

1. One objective of these studies was to provide the same "quality" of transmission service for the Canada/U.S. interchange as for other existing interchanges. Because details of the resource transactions are not known, firm and non-firm transmission ratings were determined to bracket the "quality" and have not been coordinated with the California or Canadian Task Groups.

2. These studies were performed on a "one-world" planning basis, and as such they do not address contract or wheeling issues. The results assume that acceptable transmission access arrangements can be made by all interested utilities. The proposed reinforcements required and their costs could radically change if acceptable transmission access arrangements cannot be reached.

3. The results of this study are preliminary and only for scoping purposes. The approach used in these studies was to formulate our objectives and then make extensive use of past studies and knowledge of existing system problems to formulate the conclusions of this study. The next stage of the project will require more detailed planning studies.

4. The California Oregon Transmission Project with associated Northwest reinforcements and the DC 3100 MW Expansion Project were modeled which increases the Pacific Northwest - Pacific Southwest Intertie capability to 7900 MW.

5. These studies assume that the Columbia River downstream benefits will continue to U.S. utilities.

CANADIAN SITE "C" PROJECT
TASK GROUP #3
NORTHWEST TRANSMISSION
Report on Initial Investigations

- **Committee Representatives**

Pacific Power & Light Co.

Rich Bayless - Chairman
Ron Handlin
Larry Stadler

Bonneville Power Administration

Brian Silverstein
Rick Poon
Jerilyn Krier

Portland General Electric

Mike Mikolaitis
Dick Rose
Jim Eden

The Washington Water Power
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John Apperson

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Gary Kunkel

Public Generating Pool
c/o Chelan Co. P.U.D.

Gene Lubking
Willard Fields

Puget Sound Power & Light

Rich Lauckhart
Len Karlsen

B.C. Hydro
(Canadian Liaison)

Jack Hardy

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CANADIAN SITE "C" PROJECT
TASK GROUP #3
NORTHWEST TRANSMISSION
Report on Initial Investigations

INTRODUCTION/BACKGROUND:

This report summarizes preliminary technical investigations into the impact on Northwest transmission if BC Hydro's proposed Site "C" Peace River development (900 MW) is accelerated from the year 2000 to 1994 and offered as a firm 805 MW sale to the United States. Northwest transmission is encompassed by the area defined as:

- South of the Canada/US border
- West of the Idaho/Montana systems
- North of the Oregon/California border

BC Hydro is studying their system requirements separately and will be reporting through Task Group #1, Project Details. A BC Hydro representative, acting as liaison, has been present at all working group meetings to insure the two study efforts are coordinated. This has been essential in discussions of Canada to U.S. transfer capabilities.

The Site "C" agreement dated June 12, 1986, requires "the Pacific Northwest-Pacific Southwest Intertie capability be increased to approximately 7,900 MW, including completion of the Third AC/California Oregon Transmission Project (COTP) for transmission of power from the Project (Site "C") to California." As such, our studies modeled these facilities, including the Alvey-Dixonville-Meridian 500 kV line, in service.

Any substantial change in the status of these two projects would change these Site "C" study conclusions and require more in-depth study.

The approach used in these studies was to formulate our objectives and then make extensive use of past studies and knowledge of existing system problems to formulate the conclusions of this very preliminary feasibility study.

STUDY OBJECTIVES:

The Northwest Transmission Task Group #3 mission is to report on the adequacy of the existing and planned (1994) transmission in the Northwest to deliver Site "C" project associated energy and capacity from the Canada/U.S. border either to or through the Northwest. Further, the Task Group is to identify one or more alternatives for additional transmission facilities if they are required.

Studies are to identify the firm and non-firm transfer capabilities of the 1994 system under worst case assumptions of power delivered to:

a) Loads in the Northwest only

b) Loads outside the Southern border (modeled as deliveries to California at Malin)

c) Loads outside the Eastern border (modeled as an AC load at Hatwai)

Any "bottlenecks" in the above networks will be identified.

Facility additions to add an additional 805 MW firm to the transfers from Canada will be identified. This to include facility, rough cost, approximate construction schedule and any major "showstoppers."

Approximate average and incremental Northwest losses will be determined.

The objective is to provide the same "quality" of transmission service for the Canada/U.S. interchange as for other existing interchanges. Because details of the resource transactions are not known, firm and non-firm transmission ratings were determined to bracket the "quality" of transmission. The definition of firm and non-firm transmission capacity used is shown in "Study Assumptions". These levels of "quality" have not been coordinated with the California or Canadian Task Groups.

The level of detail investigated in these studies is only to the extent to provide Site "C" signatories with enough data regarding transmission to proceed to the next phase of the project.

CONCLUSIONS:

- For the 1994 time frame there are no major technical transmission obstacles which would be showstoppers to the delivery of firm BC Hydro power to or through the Northwest at the transfer levels studied herein.

- With the recommended reinforcements and possible acceleration of already planned projects, the Northwest "grid" can transfer 805 MW of firm BC Hydro power either to Northwest loads or to the border delivery points. These recommended reinforcements will allow deliveries for all seasons and may not be required if the delivery is shaped around the limiting season.

- Environmental concerns are not expected to be of a "showstopper" nature for the required transmission reinforcements because no major additional rights-of-way are required.

- These reinforcements are relatively "minor" in cost and scale. This assumes acceptable transmission access arrangements can be made by all interested utilities. The alternatives and their costs could radically change if acceptable transmission access arrangements cannot be reached.

- Both power flow and stability studies for the Northwest U.S. transmission system indicate that the following Canada to United States transfer capabilities are possible:

  A. 1994 system without transmission reinforcements
     1200 MW --- firm
     2000 MW --- non-firm

  B. 1994 system with transmission system reinforcements (see next section)
     2000 MW --- firm
     3000 MW --- non-firm

(CONTINUED ON THE NEXT PAGE)

CONCLUSIONS: (continued)

- The following additions are necessary to achieve the transfer limits in (B) above.

Additions	Approximate Costs	Lead Time
• Rebuild Custer to Bellingham 230 kV to double circuit	$5M	4-5 years
• Boundary 230 kV phase shifter	$7M	3-4 years
• Portland area line reconductoring	$3M	2-3 years
Total	$15M	

- These reinforcements are based on studies with deliveries through the Northwest to California. Cursory studies delivering power either to the East or within the Northwest indicate no additional reinforcements, other than those listed above, are required. In fact, for these deliveries, the Portland area additions may not be required.

- For preliminary investigations of Site "C" economics, the following total energy loss wheeling adjustments would be reasonable:

Deliveries to California	6.0%
Deliveries to Northwest	2.5%
Deliveries to Eastern	2.5%

NOTE: All costs are in 1986 US dollars and are approximate.

STUDY RESULTS:

- Canada to NW Interchange

Steady state powerflow studies completed by BPA (Canada to Pacific Northwest Transfer Study, September 12, 1986) show that the Northwest system's (with 3rd AC Intertie and reinforcements plus the DC Terminal expansion) 1994 firm transfer capacity is roughly 1200 MW in the winter, 2100 MW in the spring and 1800 MW in the summer without any additional reinforcement or support facilities. These studies have also shown that Northwest system reinforcement near the Canadian border on the order of 12 million dollars, would increase the Northwest system's firm power transfer capability to approximately 2000 MW during the limiting seasons.

The steady state overloads determine the transfer limit since they occur at transfer levels lower than the maximum indicated by transient stability studies. Transient stability studies show that the 1994 system will be stable for faults in the U.S. system for firm transfer levels of at least 3000 MW.

The identified reinforcements required near the Canadian border are in the Seattle and Boundary areas. These reinforcements described below are common to all delivery scenarios.

Seattle area - For certain outages, it was assumed the PSP&L's Whitehorn generation (210 MW) was brought on line. Even with this generation, the 13 mile Custer-Bellingham single circuit 230 kV line will load to above its thermal rating for certain outages. One proposed solution is to rebuild this line to a double circuit 230 kV line. After this system is improved, the Whitehorn generation may not be required. The approximate cost of this rebuild is $5M with a 4-5 year lead time.

Puget has expressed their intent to more fully examine their own intertie with BC Hydro if Puget acquires Site "C" power, which may be an alternative to the Custer-Bellingham reinforcements.

Boundary area - The location of the Boundary area bottlenecks are very dependent on the level of Boundary generation during imports to the U.S. During light generation (200MW) the Boundary-Nelway 230 kV line will exceed its thermal rating for schedules from Canada above 1850 MW. During heavy spring generation (1000 MW) the bottleneck is the Boundary - Cusick 230 kV

line. This limit is reached during an outage of the Boundary - Sacheen - Bell 230 kV line.

A phase shifting transformer (600 MVA) between Boundary and the Canadian system was represented to relieve these overloads.

Approximate cost of the phase shifter is $7M with a 3-4 year lead time.

Three different delivery scenarios for the disposition of Site "C" power in the United States were studied. Each of the delivery scenarios, described below, are represented on the Northwest balloon plots contained in Attachment #1.

- Delivery to California scenario

The NW 4800 MW Reinforcement Project for the COTP adequately reinforces the grid from John Day south to the Oregon/California border. The cost of the NW reinforcement is being borne by the Third AC participants.

Olympia area. A Paul-Raver 500 kV outage during spring peak load conditions coupled with low thermal generation at Centralia and Trojan will cause overloads in the Olympia/ Tacoma area 230 kV system. Preliminary results show that most problems in the Olympia/ Tacoma area could be eliminated by reinforcing short sections of line with higher capacity conductor or rebuilding existing circuits. One possible solution is rebuild to double circuit the existing Cowlitz-Olympia 230 kV line. The approximate cost is $15M with a lead time of 4-5 years.

This problem is assumed to be independent of the Site "C" discussion and costs are not included in the reinforcements recommended in this study. Further detailed investigations may show a relationship between this problem and firm import levels.

Portland area. Outage of the Allston-Keeler 500 kV line or the Keeler-Pearl 500 kV line with thermal generation at Centralia and Trojan peaking will cause 230 kV line overloads in the Portland area. Preliminary results indicate that reinforcing short bottleneck sections of line with higher capacity conductor could allow firm import levels near 2000 MW. The approximate cost would be about $3 million and would require a 2-3 year lead time.

For higher levels above 2000 MW import, or if the Satsop generator is completed, it may be necessary to speed-up part or all of the Portland Area Reinforcement Project (Allston-Ross-Troutdale 500 kV line).

- Delivery to the Northwest scenario

If Site "C" power is delivered to the Northwest only, the same system problems as described under the California scenario may still exist. The degree of severity is dependent upon what Northwest resource is replaced.

- Delivery to the East scenario

To simulate the interrelation of Site "C" and deliveries to the East such as a proposed Inland Intertie, a load (800 MW) was added to the Hatwai 500 kV bus. On the surface there appear to be no system constraints other that those already noted in the Olympia and Portland areas. However, since delivery to this point impacts the east-west flow pattern (MPC-NW +15-20%) and also impacts the Canada-Boundary flow (+15%) this delivery point must be studied with NW hydro being exported to the east. It is conceivable that additional transmission may be required in the Northwest to support an East delivery. Design and analysis of a "collector system" for an Inland Intertie is currently under study.

SYSTEM LOSSES:

The cost of transmission losses will be a significant factor in determining the total economics of acquiring Site "C" power. Total energy losses from Peace River to the California border will be in the 10 - 15% range.

This breaks down as follows:

Canadian Losses

BC Hydro determined that losses on their system would be:

Peak Plant Output	900 MW
Peak Delivery at BC/US Border	805 MW
Peak Loss	10.6%
Plant Energy Output	525 Avg MW
Energy Delivery at BC/US Border	482 Avg MW
Energy Loss	8.2%

These are the losses from Peace River to the Canada/United States border.

Northwest Losses

Northwest losses are very dependent on season and loading pattern and as such vary over a wide range. The following table might be typical values:

Power Delivered to:	Low Increment 0 to 800 MW		Middle Increment 1200 to 2000 MW		High Increment 2200 to 3000 MW	
	Summer	Winter	Summer	Winter	Summer	Winter
California	8%	4%	11%	7%	14%	10%
Northwest Loads	(2%)	(3%)	(.5%)	(1%)	1%	.5%
Eastern	6%	3%	9%	6%	12%	8%

Note that the above are peak demand losses; a good approximation for energy losses is 50% of peak demand losses. This equates to a 71% load factor or 50% loss factor. Averaging the above gives:

Power Delivered to:	Demand	Energy
California	9.0%	4.5%
Northwest	Approx. 0	Approx. 0
Eastern	7.3%	3.7%

Assuming that BPA would be wheeling power for others, their present energy wheeling loss factors are as follows:

Northern Intertie	0.3%
Southern Intertie	3.0%
Network	2.0%
Total	5.3%

Network losses are not expected to change significantly in the next ten years while Southern Intertie losses will increase with the DC Terminal Expansion and the Third A.C. Project. For preliminary investigations of Site "C" economics, the following total energy loss wheeling adjustments would be reasonable:

Deliveries to California	6.0%
Deliveries to Northwest	2.5%
Deliveries to Eastern	2.5%

STUDY ASSUMPTIONS:

The following major assumptions are drawn from the BC Hydro report and are listed here as they have importance to the Northwest studies and conclusions:

Major Assumptions (Canada)

1. Interchanges with TransAlta Utilities (TAUC) would be made only if they did not impact the firm export of Site "C" power to the U. S. Thus, no interchange with TAUC was assumed in these studies.

2. Firm supply to Seattle City Light is considered to be 250 MW during BCH's peak load and up to 300 MW off-peak.

3. Boundary-Nelway 230 kV intertie and the Selkirk-Nelway 230 kV circuit are assumed to be normally closed.

4. Transmission line losses would reduce the amount of Site "C" power available for export from 900 MW to 805 MW and total energy from 4599 GWh/year to 4220 GWh/year at the Canada/U.S. border.

5. The export of electricity from Site "C" would be considered a system sale at the Canada/United States border rather than a sale of the actual Site "C" output. The BCH generation and transmission system is assumed to be adequate to deliver the above export quantities on a firm basis to the Canada/United States border.

The following are the assumptions and criteria followed in these Northwest transmission studies.

Major Assumptions (United States)

	Base Case Status	In-Service Date
1. Transmission Configuration		
a. Third AC Intertie Line	In	1/91
b. 1100 MW HVDC Terminal Expansion	In	2/89
c. Include all NWPP region specified in the WSCC Significant Additions Report, 1/1/86 through 1/1/95	In	

Major Assumptions (United States)

	Base Case Status	In-Service Date
d. Marshall-Shawnee, Beacon-Marshall, and Marshall-Westside 230 kV Lines	In	*
e. Eastern transfers represented by an 800 MW load at Hatwai	Out	**
f. Cowlitz-Olympia 230 kV line rebuilt to double circuit 230 kV	Out	***
2. Generation		
a. Satsop 1240 MW (WNP3) and Ashe 1250 MW (WNP1)	Out	
b. Hanford Two 430 MW Units (Retirement)	In	****
c. Columbia downstream benefits	Continuing	

3. Load Levels

   a. The load levels used should reflect the loading in the NWPP region for the time frame in the range of 1994 to 1996.

   b. Peak load summer case developed from the WSCC 1990 HS2 base case.

   c. Light load summer case developed from the WSCC 1993 LS1 base case.

4. Canadian/United States Study Ranges

   a. Canadian-United States transfers south of border (non-firm) -- 2000 MW to 3000 MW.

   b. Canadian-United States transfers south of border (firm) -- 1055 MW (805 + 250) to 2000 MW.

*WWP has indicated that this Project will be delayed.
**Sensitivity study only.
***Capacity increase will not affect study results.
****In studies, but expected to be retired in 1993.

c. Maximum actual transfer at the California-Oregon border is assumed to be 7900 MW (4800 MW AC and 3100 MW DC). Flow on PP&L's tie to PGandE is in addition to the 7900 MW.

d. Site "C" generation (805 MW) delivered to Northwest, Southern Oregon/Malin, or Eastern transfers (Hatwai).

e. Generation patterns for delivery of Site "C" generation are as follows:

- Site "C" generation delivered to the Northwest -- displaces available thermal units representing the worst case scenario. BPA will provide wheeling to Northwest utilities.
- Site "C" generation delivered to Southern Oregon/Malin -- reduce generation in California.
- Site "C" generation delivered to Hatwai -- reduce flow on AC Intertie lines and adjust generation pattern accordingly.

5. <u>System Performance Criteria</u>

a. Steady-state overloads: Line and station equipment emergency ratings must not be exceeded for any single contingency.

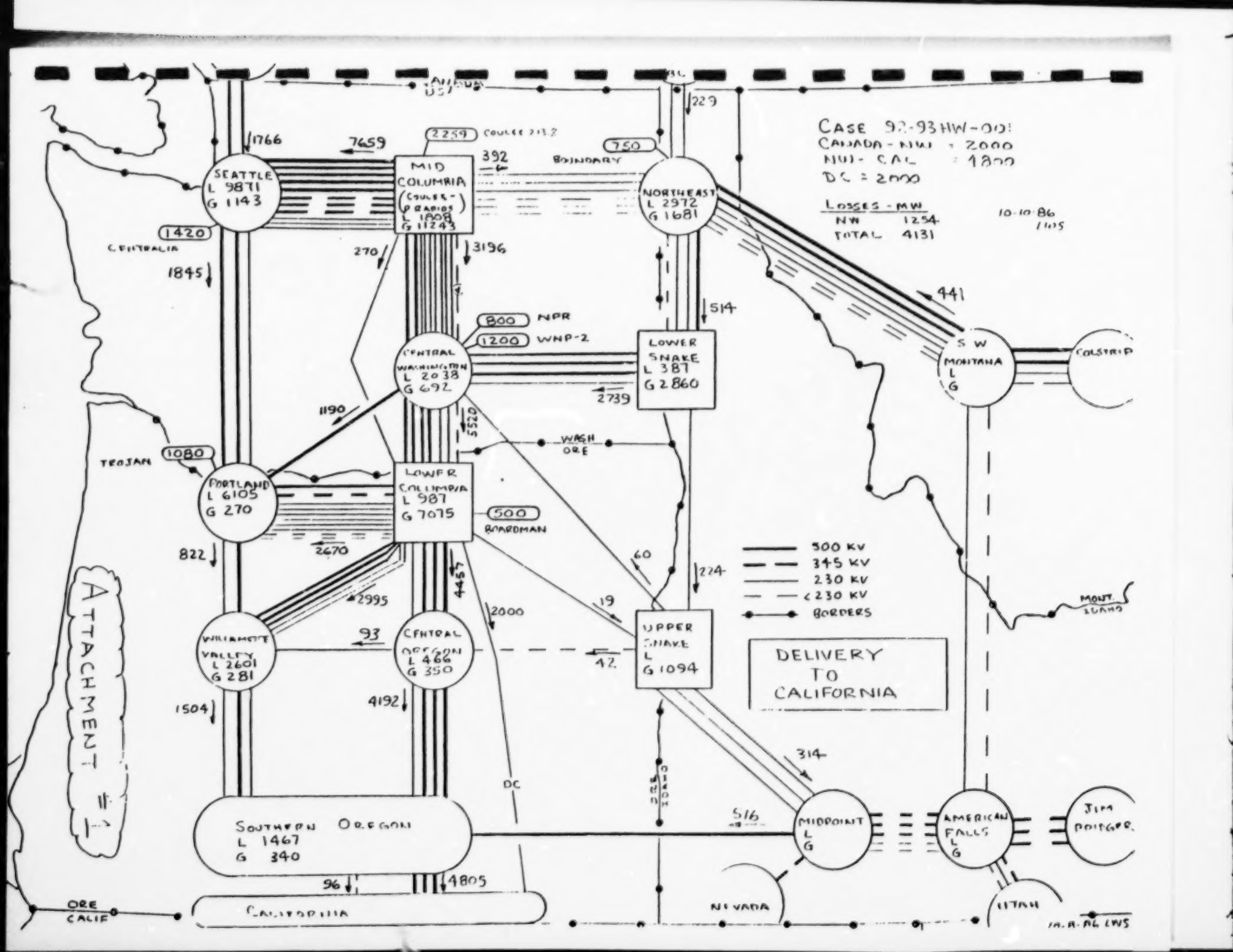
b. Transient and dynamic stability:

(1) System oscillations should exhibit positive damping.

(2) Voltages at buses with motor loads should not dip below 0.80 per unit after fault clearing.

6. Transfer Capability Definition

Constraint	(Firm) Continuous Transfer	Transfer
WSCC Reliability Criteria for System Design	Must always adhere to the performance levels specified by this criteria for all contingencies.	Same
Individual Northwest Utility Planning Criteria	Must meet.	Same
Normal System	With all transmission facilities in service, all facility voltages and loadings are within normal limits or ratings.	Same
Single Contingency Criteria	The bulk power system is capable of absorbing the dynamic power swings and remaining "stable" following the disturbance. In addition:	
. Firm Load		
- NW Utility	Dropping not allowed.	Same
- Outside NW Utility	Dropping not allowed.	Same
. Interruptible Load		
- NW Utility	Dropping allowed.	Same
- Outside NW Utility	Dropping allowed with specific consent.	Same
. Schedules	Schedule reduction is not allowed within the first 1/2-hour in order to stay below normal equipment ratings. Schedule reduction is allowed after 1/2-hour to place system in secure operating state anticipating next contingency.	Following outage, no remaining element will exceed its short time rating. Schedule reduction to firm level is allowed.
. Generation Dropping	Not allowed.	Dropping allowed in amounts that will not cause frequency to fall below limits.
. Brake Application	Allowed	Same
. Other Remedial Action	Reviewed on a case-by-case basis.	Same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CANADA - NW = 2000
NW - CAL = 1800
DC = 2000
LOSSES - MW
NW 1254
TOTAL 4131
10-10-86
1105
SEATTLE
L 9871
G 1143
MID COLUMBIA (COULEE - PRAIRIE)
L 1808
G 11243
NORTHEAST
L 2972
G 1681
CENTRAL WASHINGTON
L 2038
G 692
LOWER SNAKE
L 387
G 2860
S W MONTANA
L
G
COLSTRIP
PORTLAND
L 6105
G 270
LOWER COLUMBIA
L 987
G 7075
WILLAMETTE VALLEY
L 2601
G 281
CENTRAL OREGON
L 466
G 350
UPPER SNAKE
L
G 1094
SOUTHERN OREGON
L 1467
G 340
MIDPOINT
L
G
AMERICAN FALLS
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G
JIM BRIDGER
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COULEE 2113?
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BOUNDARY
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3196
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NPR
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WNP-2
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1190
552?
WASH
ORE
1080
TROJAN
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BOARDMAN
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4457
2995
2000
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224
19
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42
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DC
314
516
96
4805
ORE
CALIF
CALIFORNIA
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IDAHO
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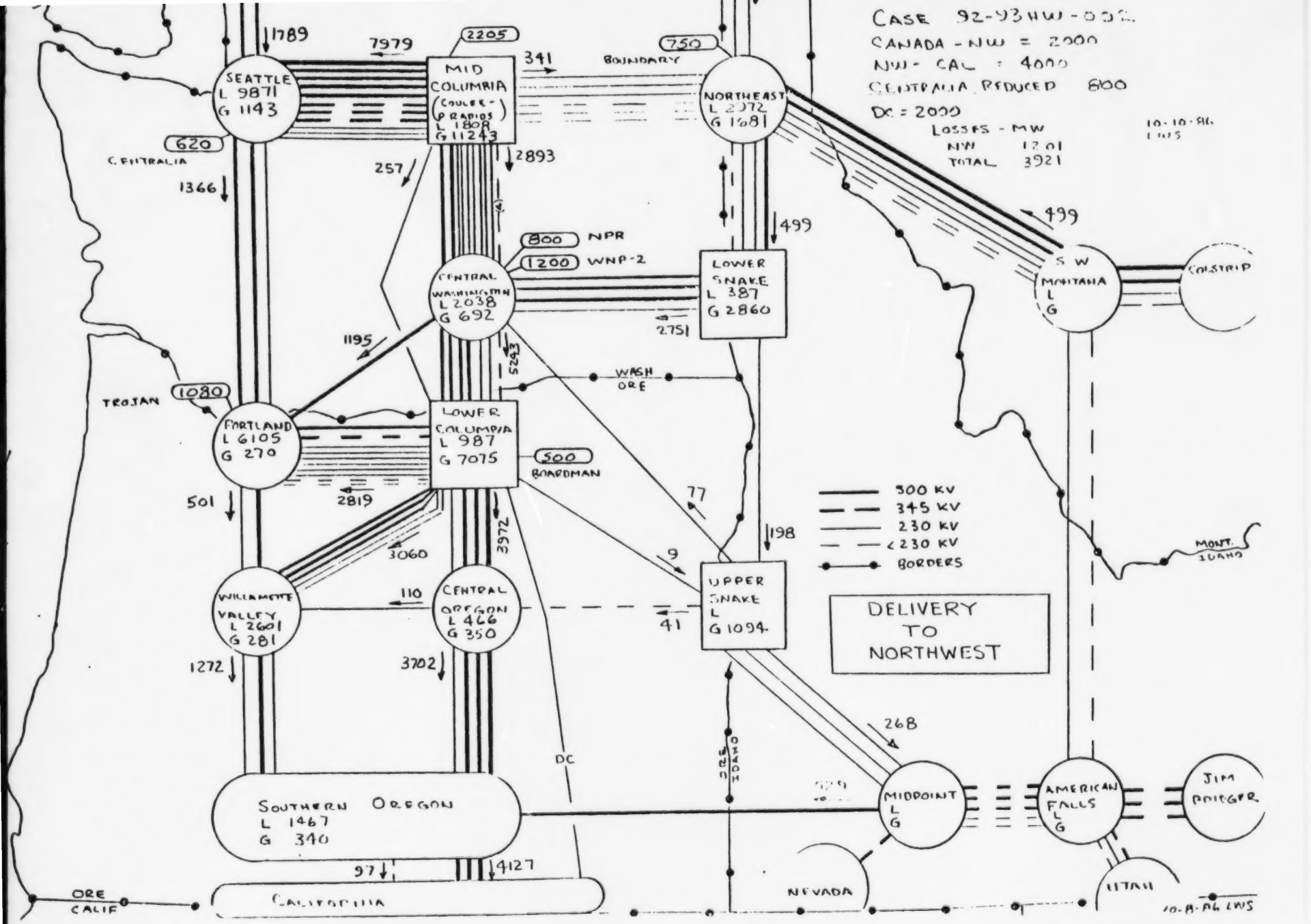
DELIVERY TO CALIFORNIA
ATTACHMENT 11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CANADA - NW = 2000
NW - CAL = 4000
CENTRALIA REDUCED 600
DC = 2000
LOSSES - MW
NW 1201
TOTAL 3921
10-10-86 LWS
SEATTLE
L 9871
G 1143
MID COLUMBIA
(COULEE - PRAIRIE)
L 1808
G 11243
NORTHEAST
L 2072
G 1681
CENTRAL WASHINGTON
L 2038
G 692
LOWER SNAKE
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G 2860
S W MONTANA
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COLSTRIP
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3972
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1272
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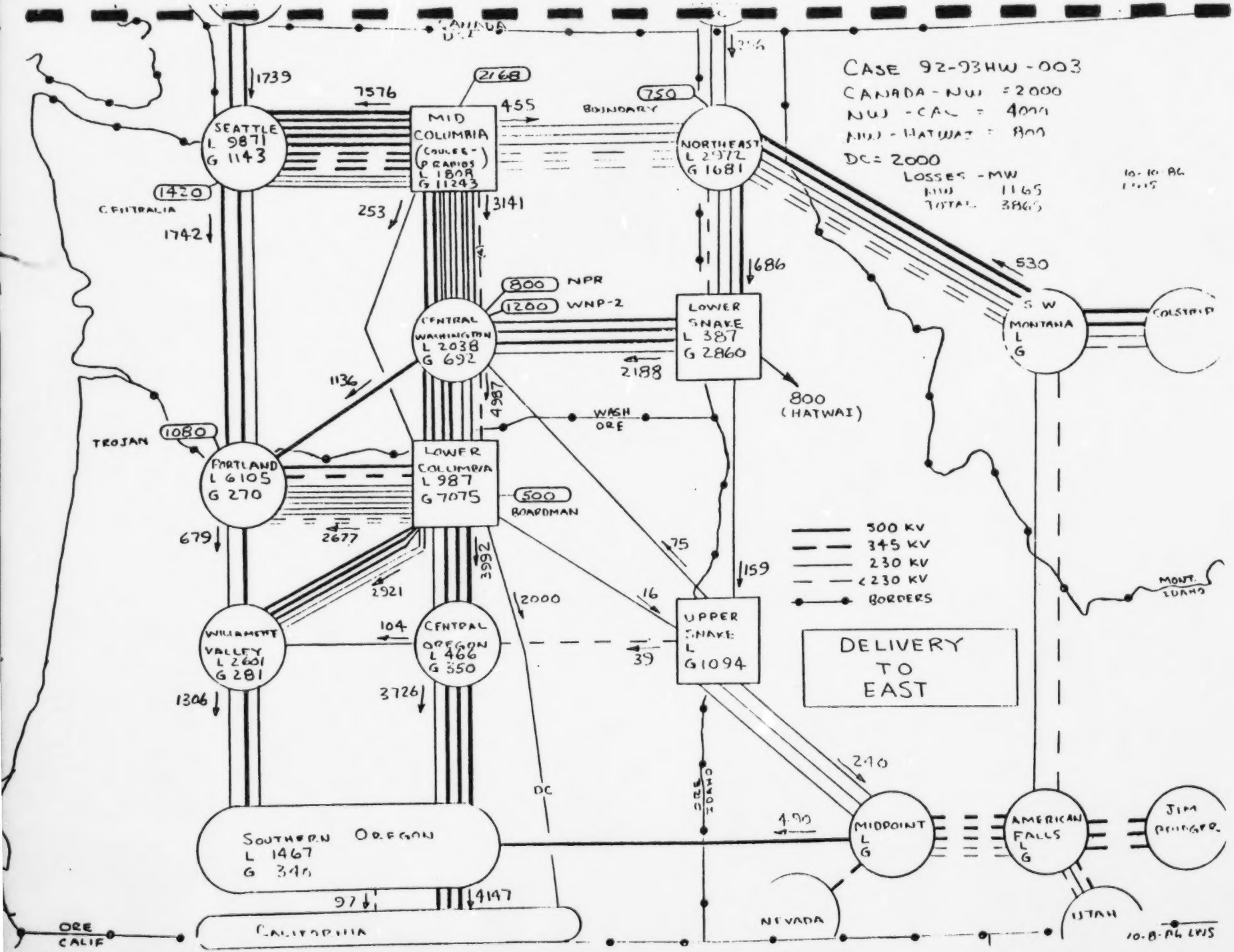
BORDERS
DELIVERY TO NORTHWEST
10-8-86 LWS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NW - HATWAI = 800
DC = 2000
LOSSES - MW
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TOTAL 3865
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L 9871
G 1143
MID COLUMBIA (COULEE - PRAIRIE)
L 1808
G 11243
NORTHEAST
L 2972
G 1681
CENTRAL WASHINGTON
L 2038
G 692
LOWER SNAKE
L 387
G 2860
S W MONTANA
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PORTLAND
L 6105
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LOWER COLUMBIA
L 987
G 7075
WILLAMETTE VALLEY
L 2601
G 281
CENTRAL OREGON
L 466
G 550
UPPER SNAKE
L
G 1094
SOUTHERN OREGON
L 1467
G 346
CALIFORNIA
MIDPOINT
L
G
AMERICAN FALLS
L
G
JIM BRIDGER
NEVADA
UTAH
ORE CALIF
1739
7576
2168
455
750
BOUNDARY
1420
C. FITZALIA
1742
253
3141
800 NPR
1200 WNP-2
686
530
2188
800 (HATWAI)
1136
498?
WASH ORE
1080
TROJAN
500 BOARDMAN
679
2677
2921
3992
2000
75
159
16
104
39
3726
1306
DC
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490
97
4147
500 KV
345 KV
230 KV
< 230 KV
BORDERS
DELIVERY TO EAST
MONT. IDAHO
10-10-86
10-8-86 LWIS

G. REPORT OF TASK GROUP #4 AND #5
CALIFORNIA AND NORTHWEST MARKET

Task Group #4 was established to identify the market requirement of the California utilities for Site C power, assuming a peak availability of 805 MW and an energy component of 4220 GW.h/a. This Task Group was chaired by R.L. Maurel, Southern Calfironia Edison Co.

Task Group #5 was established to identify the market requirement of the NW utilities for Site C power, assuming a peak availability of 805 MW and an energy component of 4220 GW.h/a. This Task Group was chaired by L. Kellerman, Portland General Electric Co.

Following an initial survey by each Task Group, a single survey format was developed that could be used by all utility participants. A single report was then produced with the combined input from the California and the Northwest market surveys.

The final report is attached.

Portland General Electric Company

November 3, 1986

D. G. McFarlane, Manager
System Engineering Division
BC Hydro and Power Authority
970 Burrard St
Vancouver BC CANADA V6Z 1Y3

Dear Mr. McFarlane:

Subject: California and Pacific Northwest Market-Specific Power and Shaping Requirements for Site C/BC System Power

On October 23, Ron Maurel of SCE, Doug Forest of BC Hydro, Young Linn of PGE, and I jointly prepared the attached marketing summary report for the Site C project. This report represents the combined input from the California marketing test groups and Pacific Northwest test groups. We have summarized the following areas of response from each participant.

1. Economics.
2. Market for Peace River Site C power.
3. Allocation.
4. Key concerns of potential participants.

Young Linn and Ron Maurel will be presenting this report to both California and Pacific Northwest Site C technical committees during a November 5 meeting in San Francisco.

Please contact me at (503) 226-5857, or Young Linn at (503) 220-3553 if you have any questions.

Sincerely,

Young Linn
For
L. M. Kellerman, Manager
Wholesale Marketing & Power Contracts

LMK/YL/llp/1500i.1186

Attachment

c: R. E. Dyer
W. K. Davis
S. Ichikawa
D. Arthur
R. Maurel (SCE)

TITLE	PAGE NO
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TABLE 1

MARKETING RESPONCE SUMMARY

INTRODUCTION

This report represents the combined input from the Marketing Task Group #4 (California) and Task Group #5 (Pacific Northwest).

The Pacific Northwest marketing survey includes responses from the majority of investor owned and publicly owned utilities in the region.

The California marketing survey includes responses from the three large investor owned utilities and the Los Angeles Department of Water and Power. Other publicly owned utilities in California, which are not signatories to the Study Agreement, may request the right to purchase a share of Site C power.

The following is a listing of utilities and utility groups which have provided affirmative responses included in this report:

Northwest

Bonneville Power Administration (BPA)
Clark County PUD (Clark County)
Idaho Power Company (IPC)
Lewis County PUD (Lewis County)
Mason County PUD (Mason County)
Montana Power Company (MPC)
Pacific Northwest Generating Company (PNGC)
Pacific Power and Light Company (PP&L)
Portland General Electric (PGE)
Public Generating Pool (PGP)
Puget Sound Power and Light Company (PSP&L)
Springfield Utility Board (Springfield)
Washington Water Power Company (WWP)

California

Los Angeles Department of Water and Power (LADWP)
Pacific Gas and Electric Company (PG&E)
San Diego Gas and Electric Company (SDG&E)
Southern California Edison Company (SCE)

EXECUTIVE SUMMARY

The Technical Committee, at its initial meeting on July 28/29, established two Task Groups to investigate the potential markets for Site C capability in the Northwest and California, respectively. Mr. L. M. Kellerman of Portland General Electric coordinated the Northwest study effort and Mr. R. L. Maurel of the Southern California Edison Company coordinated the California utilities study. This report represent the combined input from both regions.

In total, utilities in ~~both regions~~ the PNW and California expressed the potential requirement for up to 3,091 annual average MW of energy, compared against project capability of 482 MWa. This figure represents 641% of project energy producing capability. The following table reflects the potential capacity demand estimates, by season, represented as percentages of the 805 MW project capacity at the Canadian border:

Table 1

Season	PNW	CALIF	TOTAL
Spring	300%	220%	520%
Summer	344%	220%	564%
Fall	549%	220%	769%
Wnter	618%	187%	805%

These estimates of potential demand, although they total far more than the capability of Site C, are indicative of a large market available for economically attractive long term power resources, including Canadian power. A key assumption used in the preparation of utility responses was that the Site C power would be available at a delivered price competitive with each utility's most attractive alternative resource available during the mid-1990 period. This important assumption is critical in understanding and interpreting the results, and further, utility-specific analyses are warranted. Thus, this market exists only if the delivered price for the power is equal to or less than alternative sources available to the utilities.

It is not reasonable to consider an allocation of project capability among the various interested parties on the basis of these results. This report, and the efforts behind it, were undertaken to provide a ballpark estimate of the total demand for project output, how this output can be optimally shaped by the B.C. Hydro system to meet market needs, and what transmission configuration would be needed to facilitate the delivery of this power.

In the body of this report and the appendices, furthur detail is provided on the assumptions behind the projected market needs, shaping of these needs over seasonal, monthly and daily periods, and additional concerns and requirements of the potential buyers.

ECONOMICS

The submissions filed by each of the responding utilities were based on a series of assumptions, perhaps the most important of which relate to the economics of the Site C Project. Utilities were told to assume that the Site C power delivered to their systems would be cost effective relative to their alternatives in the mid-1990's. The following statement is excerpted from the assumptions section of the worksheets provided to these utilities:

> It is almost axiomatic that if the economics of this project are very attractive, all parties will wish a very large share, and if project economics are not attractive, few takers will be found. It is not the purpose of this working group to determine project economics. For purposes of this work sheet, assume that the cost of Site C power is roughly economically equivalent to your utility's most attractive alternative 20- to 30- year resource options.

Appendix I contains the complete questionnaire, including all assumptions provided to responding utilities. Comments received by many of these utilities specifically mentioned that their interest in the project would be contingent on their analysis of project economics in much greater detail than has been performed to date. The preliminary assessments which have been provided will likely change after utilities have performed such analyses.

THE MARKET FOR PEACE RIVER SITE C POWER

Based on the assumptions delineated above related to economics, and the current perceptions of the responding utilities, there appears to exist a market in the United States capable of purchasing all of the Site C power. In fact, the responses which have been provided suggest the possibility that this project may have substantially greater interest than the project's output is capable of satisfying. It is important to note that the responses do not represent management commitments, but rather reflect reasonable, non-committal estimations of the amounts of economic power which the responding utilities project a need for during the mid-1990 period and beyond. Therefore, it is not appropriate at this point to consider the project "oversubscribed"; it is rather an indication of significant interest and the potential for oversubscription if project economics, institutional constraints and other issues are satisfactorily resolved.

Table 1 summarizes the marketing responses for Northwest and California utilities, providing each utility's seasonal capacity and annual energy requirements. Based on discussions with the responding utilities and analysis of the data, it is evident that utilities did not complete these forms in a fully uniform manner. This is to be expected because each utility completed the form independently, and the assumptions provided were not all-inclusive. For example, a "rule of thumb" approach was employed to determine each utility's share of monthly project capacity by multiplying energy commitments times 1.67, to reflect the ratio of firm project energy (805 MW at the U.S.-Canada border) to total project energy (482 MWa). While this calculation works well over the entire year, on a partial year basis, allocating energy and capacity in this manner can result in seasonal disparities.

To provide furthur detail on the shaping requirements of each utility, Appendix II provides data on monthly energy and capacity requirements for both Northwest and California parties, and Appendix III provides detail on the hourly load shaping needs of each utility, by season.

ALLOCATION

The responses which are summarized in this report are not designed to be the basis for allocating Site C capability among potential purchasers. The responsibility of this Task Force was to determine the potential magnitude and shaping of market demand, not to determine a methodology for dividing Site C output among prospective buyers. The tables which are included in this report should not be considered as a basis for prorating or otherwise dividing up project output for the following reasons:

(1) Not all potential participants are included in the marketing responses. This is particularly true of the California market.

(2) The responses provided by quite a few utilities were clear in stating that the figures they sent were tentative and preliminary estimates of future need. This Task Force requested responses in a very short time frame that necessitated a cursory review of future power system requirements.

(3) As mentioned in the previous section, a uniform and consistent approach was not employed among the responding utilities in determining their future requirements.

(4) A key assumption used in preparing the responses was that economic transmission would be available to each utility requesting Site C output. In actuality, transmission constraints may limit the amounts of capacity and energy deliverable to certain utilities.

KEY CONCERNS OF POTENTIAL PARTICIPANTS

This section is intended to highlight what are considered to be the most important or recurring concerns expressed by responding utilities. A full list of written comments by each utility is provided in Appendix IV.

* It is difficult to estimate changes in energy, capacity or shaping requirements over the duration of a 20 to 30 year contract, although the consensus is that some increases in energy and capacity requirements is expected over the long term.

* Many potential purchasers wish to reserve the maximum amount of flexibility in the shaping/storage of project output. The amounts of seasonal or daily energy and capacity provided represent expected takes, but utilities wish to have substantial flexibility in changing these values over time, consistent with the capabilities of the project. Parties recognize that this is an issue which will be addressed in subsequent negotiations.

* Because of system constraints and hydroelectric potential on the Bonneville system, it was assumed that little if any Site C energy will be delivered during the April 16 to June 15 period. Some utilities desire that during this period, the capacity out of Site C should be available to back up nonfirm energy purchases from other suppliers.

* Utilities were questioned with respect to their willingness to consider energy return provisions in the event that some form of "pullback" of project energy was required by B.C. Hydro. A number of utilities found some form of energy return possible, but roughly half of the responding utilities perceived that their interest in the project woudl be "substantially reduced" if such provisions were required.

* Utilities are interested in receiving the predominant share of project energy during on-peak and weekday periods. Relatively little interest was exhibited for off-peak energy deliveries. In this survey, there was no pricing differential based on time of day considerations, and one possible approach could be to differentiate the cost based on such considerations.

MARKET-SPECIFIC POWER AND SHAPING REQUIREMENTS
JOINT PNW/PSW WORK SHEET ON SITE C/B.C. SYSTEM POWER

I. ASSUMPTIONS TO BE USED IN FILLING IN THIS WORK SHEET

A. Power capabilities at the U.S.-Canada border.

805 MW of capacity year-round; 4,220 gWh (482 MWa) energy.

B. Energy and capacity allocation.

An annual amount of 4,220 gWh (482 MWa) is expected to be made available at the U.S.-Canada border by B.C. Hydro (BCH), in a form shaped to the purchasers' needs. At times when the full 805 MW of capacity is not being used to make deliveries, the residual capacity will be available, in some form, as operational or economic reserve. The purchasers reserve the right to shape the available energy into subsequent operating periods (including years), dependent on further negotiations and BCH system and Peace River capabilities.

C. Nonobligatory scheduling of available energy.

During the period from April 15 to June 15 each year, there will be no obligation to purchase energy. Nonfirm or short-term firm energy may be purchased during this period.

D. Allocation among potential purchasers.

Allocation of Site C Project and BCH system capabilities will be determined by BCH.

E. Economic assumption.

It is almost axiomatic that if the economics of this project are very attractive, all parties will wish a very large share, and if project economics are not attractive, few takers will be found. It is not the purpose of this working group to determine project economics, though. For purposes of this work sheet, assume that the cost of Site C power is roughly economically equivalent to your utility's most attractive alternative 20- to 30-year resource options.

F. Transmission assumption.

For purposes of this work sheet, assume that satisfactory firm transmission will be provided.

1. In the mid-1990 time frame currently scheduled for project completion, specify expected amount of firm energy which your utility is interested in acquiring out of the Site C Project:

2. Recognizing that opportunities for flexibility in real time and annual scheduling are reserved for future discussion and that it is the stated intent of many parties to utilize potential shaping flexibility in the operation of their share of this project, on an "expected" basis, how does your utility wish to shape its share of firm energy and capacity over a typical operating year?

   Monthly allocations of annual energy specified in (1) above in MW-months:

   ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ = Annual total must be equal to your answer in (1) above.

   JAN FEB MAR APR JUN JUL AUG SEP OCT NOV DEC

   Monthly allocations of capacity:

   ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___ = Capacity MW per month.*

   JAN FEB MAR APR JUN JUL AUG SEP OCT NOV DEC

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* The "standard" amount of capacity is equal to your energy take in MW-months (each month) multiplied by 1.67 (805 ÷ 482). A desired amount of capacity greater than this level reflects your utility's interest in acquiring such incremental capacity from other parties at some cost or through exchange.

3. During each season in which your utility elects to receive Site C energy, during which hours would your utility generally expect to receive this energy? (It is presumed that, to the extent possible, purchasers will be afforded the opportunity to alter schedules within contracted limitations to meet then-existing operating needs.)

Typical Daily Schedule for Energy Purchases (MW)

	Spring*	Summer	Fall	Winter
0100				
0200				
0300				
0400				
0500				
0600				
0700				
0800				
0900				
1000				
1100				
1200				
1300				
1400				
1500				
1600				
1700				
1800				
1900				
2000				
2100				
2200				
2300				
2400				

* Excluding the period April 16 through June 15.

4. Do your utility's energy, capacity, or shaping requirements relative to Site C output change over the duration of a 20- to 30-year contract period? If so, please specify:

5. If energy-return provisions are required during the nonpeak energy-usage periods for your utility, how can your utility provide for such return?

_____ On an as-available basis only.

_____ On a firm basis, 100 percent load factored.

_____ On a firm basis, predominantly off-peak.

_____ Firm obligation to return, but deliveries are interruptible.

_____ Our utility's interest would be substantially reduced if energy-return provisions were a required provision.

6. This work sheet is not intended to be inclusive of all the shaping and scheduling concerns of the parties but tries to cover expected requirements. Are there any material needs or issues related to shaping, scheduling, or size of obligation that are important to your utility on which you would like to elaborate?

Monthly Allocation of Annual Energy - aMW

	Pacific Northwest														California						PNW & California Combined
	BPA	PP&L	PGE	PSP&L	WWP	PGP	SPRING-FIELD	PNGC	LEWIS COUNTY	MASON COUNTY	NPC	CLARK COUNTY	IPC	TOAL	PG&E	LADW&P	SDG&E	SCE	TOAL		TOTAL
Jan	984	300	100	837	170	646	3	185	24	37.5	150	80.8	100	3,617	608	0	50	324	982		4,599
Feb	964	300	100	521	170	591	3	196	24	37.5	150	80.8	100	3,237	201	0	50	324	575		3,812
Mar	964	0	50	521	150	507	3	162	24	30	30	80.8	0	2,522	201	0	50	324	575		3,097
Apr *	0	0	20	463	60	331	1.5	72	24	30	0	80.8	0	1,082	201	0	25	324	550		1,632
May						217						53.9		271							271
Jun *	0	120	20	405	60	303	1.5	95	24	25	0	53.9	50	1,157	732	160	25	324	1,241		2,398
Jul	0	300	50	405	120	370	1.5	215	24	25	75	53.9	100	1,739	732	160	50	324	1,266		3,005
Aug	0	300	100	405	120	312	1.5	208	24	25	75	53.9	100	1,724	805	160	50	324	1,339		3,063
Sept	0	300	100	405	120	422	1.5	192	24	25	30	53.9	50	1,723	805	160	50	324	1,339		3,062
Oct	964	180	100	463	135	463	1.5	140	24	25	30	53.9	50	2,629	805	160	50	324	1,339		3,968
Nov	964	300	100	521	160	546	3	170	24	30	30	53.9	50	2,952	608	0	50	324	982		3,934
Dec	964	300	100	838	165	608	3	165	24	37.5	150	80.8	100	3,535	608	0	50	324	982		4,517

* In some cases it was assumed for May 1-16 & Jun 16-30

Monthly Allocation of Capacity - Mw

	Pacific Northwest														California						PNW & California Combined
	BPA	PP&L	PGE	PSP&L	WWP	PGP	SPRING-FIELD	PNGC	LEWIS COUNTY	MASON COUNTY	NPC	CLARK COUNTY	IPC	TOTAL	PG&E	LADW&P	SDG&E	SCE	TOAL		TOTAL
Jan	1610	504	117	1398	300	922	5.01	250	40	62.3	251	135	167	5,761	805	0	100	600	1,505		7,266
Feb	1610	504	117	870	300	843	5.01	250	40	62.3	251	135	167	5,154	805	0	100	600	1,505		6,659
Mar	1610	0	117	870	300	764	5.01	250	40	50.1	50	135	0	4,191	805	0	100	600	1,505		5,696
Apr	0	0	117	773	200	623	2.5	250	40	50.1	0	135	0	2,191	805	0	100	600	1,505		3,696
May						346						90		436	805	267	100	600	1,772		2,208
Jun	0	204	117	676	200	518	2.5	250	40	50.1	0	90	83	2,231	805	267	100	600	1,772		4,003
Jul	0	504	117	676	200	559	2.5	250	40	41.8	135	90	167	2,782	805	267	100	600	1,772		4,554
Aug	0	504	117	676	200	455	2.5	250	40	41.8	135	90	167	2,678	805	267	100	600	1,772		4,450
Sept	0	504	117	676	200	614	2.5	250	40	41.8	50	90	83	2,668	805	267	100	600	1,772		4,440
Oct	1610	300	117	773	200	706	2.5	250	40	50.1	50	90	83	4,272	805	267	100	600	1,772		6,044
Nov	1610	504	117	870	300	802	5.01	250	40	50.1	50	90	83	4,771	805	0	100	600	1,505		6,276
Dec	1610	504	117	1399	300	853	5.01	250	40	62.3	251	135	167	5,693	805	0	100	600	1,505		7,198

* In some cases it was assumed for May 1-16 & Jun 16-30

SPRING *
Typical Daily Schedule for Energy Purchase (MW)

	Pacific Northwest														California					PNW & California Combined
	BPA	PPLL	PSE	PSPLL	WWP	PGP	SPRING-FIELD	PNGC	LEWIS COUNTY	MASON COUNTY	NPC	CLARK COUNTY	IPC	TOTAL	PGLE*	LADWLP*	SDGLE**	SCE*	TOAL	TOTAL
100	0	0	0	0	0	314	1.24	0	0	15	0	53.9	100	484	0	0	0	0	0	484
200	0	0	0	0	0	312	1.13	0	0	15	0	53.9	100	482	0	0	0	0	0	482
300	0	0	0	0	0	313	1.11	0	0	15	0	53.9	100	483	0	0	0	0	0	483
400	0	0	0	0	0	313	1.12	0	0	15	0	53.9	100	483	0	0	0	0	0	483
500	0	0	0	0	0	315	1.14	0	20	15	0	53.9	100	505	0	0	0	0	0	505
600	0	0	0	0	0	321	1.24	0	30	30	0	53.9	100	536	0	0	0	0	0	536
700	0	0	117	0	0	331	1.47	250	40	50	45	53.9	100	988	0	267	100	0	367	1,355
800	0	192	117	822	250	469	1.73	250	40	50	45	53.9	100	2,391	400	267	100	600	1,367	3,758
900	0	192	117	822	250	468	1.78	250	40	40	45	53.9	100	2,380	400	267	100	600	1,367	3,747
1000	0	192	117	822	250	468	1.75	250	40	40	45	53.9	100	2,380	805	267	100	600	1,772	4,152
1100	0	192	117	822	250	465	1.74	250	36	35	45	53.9	100	2,368	400	267	100	600	1,367	3,735
1200	0	192	117	822	250	463	1.64	250	30	35	45	53.9	100	2,360	400	267	100	600	1,367	3,727
1300	0	192	117	822	250	456	1.64	250	30	35	45	53.9	100	2,353	0	267	100	600	967	3,320
1400	0	192	117	822	250	454	1.62	250	30	35	45	53.9	100	2,351	0	267	100	600	967	3,318
1500	0	192	117	822	250	453	1.57	250	30	35	45	53.9	100	2,349	0	267	100	600	967	3,316
1600	0	192	117	822	250	451	1.57	250	40	35	45	53.9	100	2,357	0	267	100	600	967	3,324
1700	0	192	117	822	250	449	1.53	249	40	40	45	53.9	100	2,359	400	267	100	600	1,367	3,726
1800	0	192	117	822	250	453	1.61	249	40	40	45	53.9	100	2,364	805	267	100	600	1,772	4,136
1900	0	192	117	822	250	386	1.61	249	40	35	45	53.9	100	2,292	805	267	100	600	1,772	4,064
2000	0	192	117	822	250	391	1.63	249	30	30	45	53.9	100	2,282	400	267	100	600	1,367	3,649
2100	0	192	117	822	250	392	1.64	249	20	20	45	53.9	100	2,263	0	267	100	600	967	3,230
2200	0	192	117	822	250	389	1.6	249	0	20	45	53.9	100	2,240	0	267	100	600	967	3,207
2300	0	0	0	0	0	322	1.5	0	0	20	0	53.9	100	497	0	0	100	0	100	597
2400	0	0	0	0	0	318	1.4	0	0	20	0	53.9	100	493	0	0	0	0	0	493

* Excluding the period April 16 through June 15

*Typical weekdays - typical weekend schedules may be different
**Weekdays only - non on weekends

SUMMER
Typical Daily Schedule for Energy Purchase (MW)

	Pacific Northwest														California					PNW & California Combined
	BPA	PP&L	PGE	PSP&L	WWP	PSP	SPRING-FIELD	PNGC	LEWIS COUNTY	MASON COUNTY	NPC	CLARK COUNTY	IPC	TOTAL	PG&E*	LADWP*	SDG&E**	SCE*	TOAL	TOTAL
100	0	0	0	0	0	298	1.3	0	0	15	0	53.9	100	468	805	0	0	0	805	1,273
200	0	0	0	0	0	296	1.16	0	0	15	0	53.9	100	466	805	0	0	0	805	1,271
300	0	0	0	0	0	296	1.11	0	0	15	0	53.9	100	466	805	0	0	0	805	1,271
400	0	0	0	0	0	296	1.1	0	0	15	0	53.9	100	466	805	0	0	0	805	1,271
500	0	0	0	0	0	296	1.11	0	20	15	0	53.9	100	486	805	0	0	0	805	1,291
600	0	0	0	0	0	298	1.17	0	30	25	0	53.9	100	508	805	0	0	0	805	1,313
700	0	144	117	0	0	301	1.33	250	40	40	113	53.9	100	1,160	805	267	100	0	1,172	2,332
800	0	504	117	676	200	411	1.55	250	40	40	113	53.9	100	2,506	805	267	100	600	1,772	4,278
900	0	504	117	676	200	414	1.64	250	40	40	113	53.9	100	2,510	805	267	100	600	1,772	4,282
1000	0	504	117	676	200	414	1.68	250	40	30	113	53.9	100	2,500	805	267	100	600	1,772	4,272
1100	0	504	117	676	200	415	1.72	250	36	30	113	53.9	100	2,497	805	267	100	600	1,772	4,269
1200	0	504	117	676	200	415	1.71	250	30	30	113	53.9	100	2,491	805	267	100	600	1,772	4,263
1300	0	504	117	676	200	414	1.72	250	30	30	113	53.9	100	2,490	805	267	100	600	1,772	4,262
1400	0	504	117	676	200	413	1.7	250	30	30	113	53.9	100	2,489	805	267	100	600	1,772	4,261
1500	0	504	117	676	200	413	1.67	250	30	30	113	53.9	100	2,489	805	267	100	600	1,772	4,261
1600	0	504	117	676	200	415	1.66	250	40	30	113	53.9	100	2,501	805	267	100	600	1,772	4,273
1700	0	504	117	676	200	414	1.65	249	40	35	113	53.9	100	2,504	805	267	100	600	1,772	4,276
1800	0	504	117	676	200	414	1.64	249	40	30	113	53.9	100	2,499	805	267	100	600	1,772	4,271
1900	0	504	117	676	200	342	1.63	249	40	30	113	53.9	100	2,427	805	267	100	600	1,772	4,199
2000	0	504	117	676	200	340	1.59	249	30	15	113	53.9	100	2,399	805	267	100	600	1,772	4,171
2100	0	504	117	676	200	340	1.59	249	20	15	113	53.9	100	2,389	805	267	100	600	1,772	4,161
2200	0	0	117	676	200	342	1.63	249	0	15	113	53.9	100	1,868	805	267	100	600	1,772	3,640
2300	0	0	0	0	0	304	1.54	0	0	15	0	53.9	100	474	805	0	100	0	905	1,379
2400	0	0	0	0	0	301	1.43	0	0	15	0	53.9	100	471	805	0	0	0	805	1,276

*Typical weekdays - typical weekend schedules may be different
**Weekdays only - non on weekends

FALL

Typical Daily Schedule for Energy Purchase (MW)

	Pacific Northwest														California					PNW & California Combined TOTAL
	BPA	PP&L	PGE	PSP&L	WWP	PSP	SPRING-FIELD	PNGC	LEWIS COUNTY	MASON COUNTY	NPC	CLARK COUNTY	IPC	TOTAL	PG&E*	LADWP*	SDG&E**	SCE*	TOAL	
100	0	0	0	0	0	378	2.5	0	0	15	0	80.8	0	476	805	0	0	0	805	1,281
200	0	0	0	0	0	376	2.29	0	0	15	0	80.8	0	474	805	0	0	0	805	1,279
300	0	0	0	0	0	375	2.22	0	0	15	0	80.8	0	473	805	0	0	0	805	1,278
400	0	0	0	0	0	376	2.21	0	0	15	0	80.8	0	474	805	0	0	0	805	1,279
500	0	0	0	0	0	379	2.24	0	20	15	0	80.8	0	497	805	0	0	0	805	1,302
600	0	0	0	0	0	384	2.45	0	30	30	0	80.8	0	527	805	0	0	0	805	1,332
700	300	504	117	0	0	394	3.18	250	40	50	45	80.8	0	1,784	805	267	100	0	1,172	2,956
800	1610	504	117	822	250	517	3.82	250	40	50	45	80.8	75	4,365	805	267	100	600	1,772	6,137
900	1610	504	117	822	250	515	3.81	250	40	40	45	80.8	75	4,353	805	267	100	600	1,772	6,125
1000	1610	504	117	822	250	512	3.63	250	40	40	45	80.8	75	4,349	805	267	100	600	1,772	6,121
1100	1610	504	117	822	250	511	3.52	250	36	35	45	80.8	75	4,339	805	267	100	600	1,772	6,111
1200	1610	504	117	822	250	508	3.39	250	30	35	45	80.8	75	4,330	805	267	100	600	1,772	6,102
1300	1610	504	117	822	250	507	3.22	250	30	35	45	80.8	75	4,329	805	267	100	600	1,772	6,101
1400	1610	504	117	822	250	499	3.14	250	30	35	45	80.8	75	4,321	805	267	100	600	1,772	6,093
1500	1610	504	117	822	250	490	3.01	250	30	35	45	80.8	75	4,312	805	267	100	600	1,772	6,084
1600	1610	504	117	822	250	490	2.94	250	40	35	45	80.8	75	4,322	805	267	100	600	1,772	6,094
1700	1610	504	117	822	250	493	3.1	249	40	40	45	80.8	75	4,329	805	267	100	600	1,772	6,101
1800	1610	504	117	822	250	505	3.46	49	40	40	45	80.8	75	4,341	805	267	100	600	1,772	6,113
1900	1610	504	117	822	250	512	3.43	249	40	35	45	80.8	75	4,343	805	267	100	600	1,772	6,115
2000	1610	504	117	822	250	511	3.28	249	30	30	45	80.8	75	4,327	805	267	100	600	1,772	6,099
2100	1610	144	117	822	250	508	3.04	249	20	20	45	80.8	75	3,944	805	267	100	600	1,772	5,716
2200	300	0	117	822	250	505	2.92	249	0	20	45	80.8	75	2,467	805	267	100	600	1,772	4,239
2300	0	0	0	0	0	384	2.72	0	0	20	0	80.8	75	563	805	0	100	0	905	1,468
2400	0	0	0	0	0	380	2.47	0	0	20	0	80.8	0	483	805	0	0	0	805	1,288

*Typical weekdays - typical weekend schedules may be different
**Weekdays only - non on weekends

WINTER

Typical Daily Schedule for Energy Purchase (MW)

	Pacific Northwest														California					PNW & California Combined
	BPA	PP&L	PGE	PSP&L	WWP	PGP	SPRING-FIELD	PNGC	LEWIS COUNTY	MASON COUNTY	NPC	CLARK COUNTY	IPC	TOTAL	PG&E*	LADWLP*	SDG&E**	SCE*	TOTAL	TOTAL
100	0	0	0	0	0	561	2.5	0	0	18	0	80.8	100	762	0	0	0	0	0	762
200	0	0	0	0	0	560	1.35	0	0	18	0	80.8	100	760	0	0	0	0	0	760
300	0	0	0	0	0	559	2.32	0	0	18	0	80.8	100	760	0	0	0	0	0	760
400	0	0	0	0	0	559	2.36	0	0	18	0	80.8	100	760	0	0	0	0	0	760
500	0	0	0	0	0	561	2.44	0	20	18	0	80.8	100	782	0	0	0	0	0	782
600	0	0	0	0	0	568	2.63	0	30	30	0	80.8	100	811	0	0	0	0	0	811
700	300	504	117	0	0	588	3.11	250	40	55	225	80.8	100	2,263	400	0	100	0	500	2,763
800	1610	504	117	1219	300	693	3.68	250	40	55	225	80.8	100	5,197	805	0	100	600	1,505	6,702
900	1610	504	117	1219	300	707	3.73	250	40	50	225	80.8	100	5,207	805	0	100	600	1,505	6,712
1000	1610	504	117	1219	300	728	3.57	250	40	50	225	80.8	100	5,227	805	0	100	600	1,505	6,732
1100	1610	504	117	1219	300	724	3.37	250	34	50	225	80.8	100	5,219	805	0	100	600	1,505	6,724
1200	1610	504	117	1219	300	709	3.27	250	30	50	225	80.8	100	5,198	805	0	100	600	1,505	6,703
1300	1610	504	117	1219	300	701	2.5	250	30	50	225	80.8	100	5,189	805	0	100	600	1,505	6,694
1400	1610	504	117	1219	300	696	3.18	250	30	45	225	80.8	100	5,180	805	0	100	600	1,505	6,685
1500	1610	504	117	1219	300	689	3.11	250	30	45	225	80.8	100	5,173	805	0	100	600	1,505	6,678
1600	1610	504	117	1219	300	689	3.08	250	40	40	225	80.8	100	5,178	805	0	100	600	1,505	6,683
1700	1610	504	117	1219	300	695	3.13	249	40	40	225	80.8	100	5,183	805	0	100	600	1,505	6,688
1800	1610	504	117	1219	300	712	3.31	249	40	50	225	80.8	100	5,210	805	0	100	600	1,505	6,715
1900	1610	504	117	1219	300	712	3.36	249	40	50	225	80.8	100	5,210	805	0	100	600	1,505	6,715
2000	1610	504	117	1219	300	704	3.29	249	30	45	225	80.8	100	5,187	805	0	100	600	1,505	6,692
2100	1610	144	117	1219	300	696	3.19	249	20	35	225	80.8	100	4,799	805	0	100	600	1,505	6,304
2200	300	0	117	1219	300	680	3.03	249	0	30	225	80.8	100	3,304	805	0	100	600	1,505	4,809
2300	0	0	0	0	0	590	2.84	0	0	20	0	80.8	100	794	805	0	100	0	905	1,699
2400	0	0	0	0	0	576	2.65	0	0	20	0	80.8	100	779	400	0	0	0	400	1,179

*Typical weekdays - typical weekend schedules may be different
**Weekdays only - non on weekends

Q.4
Do your Utility's energy, capacity or shaping requirements, relative to Site C output change over the duration of 20 to 30 year contract period? If so, please specify.

BPA

Energy and capacity requirements start as early as 1994-1995 when the region goes deficit under a most likely load growth scenario, and increase to the maximum output of the energy by about 1997-1998. Shaping requirements remain about the same.

PP&L, MASON COUNTY, WWP, SPRINGFIELD, IPC

No

PGE

We expect both energy and capacity requirements to increase from the mid - 1990's forward. At least a portion of this increased requirement could be met by additional Site C output.

COWLITZ

As the District experiences further load growth, additional purchase of Site C may be possible.

PGP

Yes, but at this time it is difficult to determine what those changes will be in the next 20 to 30 years.

LEWIS COUNTY, SCL

Unknown at this time

MPC

Yes, the load requirements increase over time. Beyond 2000 the requirement may increase 15-20 avg MW per year.
The load shape will also change over time. The load shape may "flatten out" over time.

Q.5
If energy-return provisions are required during the non-peak energy-usage periods for your utility, how would your utility prefer to provide for such return?

BPA, PGP, EW&EB, LEWIS, MASON	On an as - available basis only.
	On a firm basis, 100 percent load factored.
BPA, PP&L, PGP, PGE, SCL	On a firm basis, predominantly off-peak.
BPA, PNGC, MPC, IPC	Firm obligation to return, but deliveries are interruptible.
PP&L, Cowlitz, PGP, Springfield, MPC, Clark	Our utilities interest would be substantially reduced if energy-return provisions were a required provision.

Q.6
This work sheet is not intended to be inclusive of all the shaping and scheduling concerns of the parties but tries to cover expected requirements. Are there any material needs or issues related to shaping, scheduling, or size of obligation that are important to your utility on which you would like to elaborate?

BPA

1. BPA may be interested in additional options or purchases of capacity or reserve capacity in September.

2. Capacity and energy need to be available on a prescheduled basis.

3. Is this an energy shaping service only such that when the energy take is complete for a month the sale ceases, or is a capacity purchase also offered wherein energy beyond the agreed energy take is returned during off-peak hours?

4. If this is a system sale, the purchaser should have the right to receive energy and capacity regardless of Site C availability. If it is a project sale, the purchaser would need input into the operation.

PP&L

Due to Pacific being a predominately thermal system with base loading, light load energy is of lessor use to our system.

PGE

See response to Q.4

WWP

We would like to have the power delivered to us on a firm basis without the right for Canada to cut deliveries to serve Canadian markets.

COWLITZ

The BPA P.F rate design at the time of purchase could be important to consider.

PGP, SCL

Responses to this questionnaire are gross estimates and reflect no substantial analysis. Considerably, more detail in terms of cost and potential contract provisions are needed before better figures could be generated.

MPC

The above responses represent a very quick look of MPC's hourly load shape. The above load shape assumes that the load shapes that occured in 1985 are representative of the load shape in the mid 90's. If programmatic Conservation, Model Conservation standards or load management are successfully implemented, then the assumption made will not be valid.

With the limited amount of information that was included with this questionnaire the compatibility of the resource with MPC's nees is questionable.

CLARK COUNTY, IPC

Not at this time / no

MISC. NOTES
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* VERA WATER & POWER
As a full requirements customer, I think BPA should investigate Site C as a reginal resource.

* CENTRAL LINCOLN P.U.D.
No apparent attempt was made, to make this survey vehicle realistically answerable by the great majority of BPA customer utilities. Perhaps a better forum, in which to discuss the basic question, would be at BPA's customer meetings.

TABLE 1

Peace River Site C
Marketing Responce Summary
Pacific Northwest

		BPA	PP&L	PGE	PSP&L	WWP	PGP	SPRING-FIELD	PNGC	LEWIS COUNTY	MASON COUNTY	KPC	CLARK COUNTY	IPC	TOTAL
Peak MW															
	Spring	0	192	117	805	300	469	5.0	250	40	50.1	50	135	0	2,413
	Summer	0	504	117	805	200	415	2.5	250	40	41.8	135	90	167	2,767
	Fall	1,610	504	117	805	300	517	2.5	250	40	50.1	50	90	83	4,419
	Winter	1,610	504	117	805	300	728	5.0	250	40	62.6	251	135	167	4,975
GWH		4,237	1,752	613	4,222	1,044	3,881	17.5	1,314	193	239.1	526	570	511	19,119
MWA		484	200	70	482	119	443	2	150	22	27	60	65	58	2,183

Peace River Site C
Marketing Responce Summary
California Utilities

		PG&E	LADWP	SDG&E	SCE	TOTAL
Peak MW						
	Spring	805	267	100	600	1,772
	Summer	805	267	100	600	1,772
	Fall	805	267	100	600	1,772
	Winter	805	0	100	600	1,505
GWH		4,220	525	365	2,412	7,522
MWA		482	60	42	324	908

		PNW & California Combined TOTAL
Peak MW		
	Spring	4,185
	Summer	4,539
	Fall	6,191
	Winter	6,480
GWH		26,641
MWA		3,091

H. OTHER EXECUTIVE COMMITTEE QUESTIONS

At the 24 September 1986 meeting of the Executive Committee two further questions were assigned to the Technical Working Group.

(1) BPA was requested to define the environmental studies that would be needed for a Peace Site C sale. Gary Fuqua, BPA's representative on the Technical Working Group undertook the task to outline the process to be followed and define the EIS required. BPA's report entitled "BPA Environmental Issues relating to Site C" is attached.

(2) BPA and BCH were asked to define the existing benefits that PNW utilities may forego if the Canada/U.S. intertie is partially loaded in the future with firm energy sales from Peace Site C. Doug Forrest, B.C. Hydro's Manager of Power Marketing was asked to coordinate a response with Gary Fuqua from BPA. Their joint report entitled "Surplus Marketing Limitations of Canada/U.S. Intertie" is attached.

BPA ENVIRONMENTAL ISSUES RELATING TO SITE C

If BPA is involved in BC Hydro's Site C proposed hydroelectric project, whether it is a purchase of power from the project, with or without resale to the Pacific Southwest, or wheeling the power to another utility, NEPA compliance activities will have to be completed prior to implementation. Assuming that there is enablement of the Site C project, an EIS process is expected to be required because of the scale of impacts of the construction of the Site C project itself and the NEPA and DOE requirements relating to the consideration of impacts which occur outside the United States. Attached is a very tentative schedule. It is very tentative because there is not sufficient information relating to the proposal, the extent of analysis required, or controversy which may be encountered. About 80 weeks would tentatively be scheduled to complete such an EIS, assuming the fastest track to completion.

The seemingly applicable part of the DOE guidelines (Subsection 4.2) requires preparation of either a "bilateral or multilateral environmental study relevant or related to the proposed action . . . to be conducted by the United States and one or more foreign nations, or by an international body or organization of which the United States is a member or participant", or a concise analysis of the environmental issues involved including environmental assessments, summary environmental analyses, or other appropriate documents" for cases of "major Federal actions significantly affecting the environment of a foreign nation not participating with the United States and not otherwise involved in the action" (emphasis added).

The DOE guidelines (Subsection 14.2) allow adoption of "all or part of existing environmental analyses, including those prepared by foreign countries or international organizations when DOE determines that these analyses are adequate in scope and content to fulfill the requirements of these guidelines." Subsection 14.1 states that DOE "will not have to prepare any document or study required by Section 4 of these guidelines if it determines that a document or study already exists that is adequate in scope and content to meet the requirements of these guidelines." Finally, Subsection 14.5 of the DOE Guidelines says that if an Environmental Impact Statement (EIS) is being prepared to address impacts within the United States of a major Federal action, and significant impacts also occur upon the environment of a foreign nation, the EIS does not have to contain a review of the foreign impacts; rather the appropriate type of environmental review, as described in Section 4.2, may be issued as a separate document.

In light of these somewhat confusing and conflicting guidelines, and the fact that BPA has not completely evaluated or even necessarily identified all relevant environmental documentation on Site C, BPA's current thinking is that an EIS will likely be required on the basis of U.S. impacts alone from a proposal to import power from a dam at Site C and that the EIS would simply be scoped to address impacts occurring in Canada as well as the impacts in the U.S. This could change pending identification of further environmental documentation of Canadian impacts.

The following is a list of topic areas which would be addressed in such an EIS with a brief statement of information required for an environmental analysis.

1. Construction and Operation of the Site C Project

- Information required to start environmental analysis:

  — A description of the existing environment in Canada which will be affected by the dam, such as:
    Peace River hydrology
    Peace River water quality
    Peace River fisheries
    Land use
    Socioeconomics of the affected communities
    Wildlife
    Historic and archeological sites
    Aesthetic values
    Geology; etc.

  — A description of the proposed construction activities, the proposed dam itself, and a thorough description of any mitigation activities which are being proposed.

  — All existing environmental studies relating to the project.

- Near-term tasks

  One task could be pursued in the near term. That would be to identify and survey all available environmental information relating to Site C, and determine what information exists and what additional information needs to be developed.

2. Transmission in Canada

- Information required to start environmental analysis

  — A description of the transmission facilities proposed for moving Peace Site C power to the U.S. border, the schedule for construction of these facilities, and a description of any mitigation measures (or at least a thorough discussion of alternatives for the preceding).

  — A description of the environment affected by the proposed and/or alternative Canadian transmission facilities, such as:
    Land Use
    Wildlife
    Geology
    Aesthetic values
    Historic and archeological sites, etc.

  — All existing environmental studies relating to the proposed and/or alternative Canadian transmission.

- Near-term tasks

  Information should be secured regarding transmission requirements for moving power from the Site C project to the U.S. border, so that environmental analysis of the impacts of the transmission could proceed.

3. Transmission in the U.S.

- Information required to start environmental analysis:

  — A description of the transmission facilities proposed for moving Peace Site C power from the U.S. border to the market to be served, the schedule for construction of these facilities, and a description of any mitigation measures (or at least a thorough discussion of alternatives for the preceding).

  — A description of the environment affected by the proposed and/or alternative U.S. transmission facilities to include the same types of information as needed for the Canadian transmission above.

  — All existing environmental studies relating to the proposed and/or alternative U.S. transmission.

- Near-term tasks

  Define transmission requirements within the U.S.

4. Impacts from changes in the operation of the Canadian, Pacific Northwest, and the Pacific Southwest power systems

- Information required to begin environmental analysis:

  — Terms of a proposed and/or alternative agreements concerning the import of Site C power to include the amount of energy, capacity, or power imported and its shape for each purchaser of Site C power.

  — Costs incurred by each party to the transactions.

  — Any provisions for load shaping, storage, reserves, or other services to be supplied through use of the Canadian, Pacific Northwest, or Pacific Southwest generation systems.

  — Any recall provisions.

  — Any provisions relating to the exchange of energy.

  — Any other provisions affecting the operation of the Canadian, Pacific Northwest or Pacific Southwest generation systems.

  — An estimate of the transmission losses for delivery from the project to each purchaser of Site C power.

— An estimate of the transmission capacity available to transmit power from the Site C project to the markets being served.

- Near-term tasks

These could include an analyses of impacts on the Canadian, Pacific Northwest, and Pacific Southwest power systems by looking at a number of cases which we believe encompass the range of possible terms of the sale and possible transmission alternatives.

SITE C EIS SCHEDULE

	Time Required	Elapsed Time
Prepare DEIS	52 weeks	
Public Comment Period	60 days	60 weeks
Finalize EIS and Mail to Public	12 weeks	72 weeks
No Action Period	30 days	76 weeks
Prepare and Public ROD	4 weeks	80 weeks

Note: This schedule assumes the most rapid schedule for completion of the EIS work. A more likely schedule would extend to 104 weeks.

RSeiffert:pat (WP-PGC-4675K)
WP-P-1940D

SURPLUS MARKETING LIMITATIONS OF CANADA/US INTERTIE

1. Introduction

At the 24 September 1986 meeting of the Site C Executive Committee, B.C. Hydro (BCH) and Bonneville Power Administration (BPA) were requested to determine the benefits that BCH and Pacific Northwest (PNW) utilities would forego if their transmission systems were partially loaded in the future with a firm energy sale from the Peace Site C Project.

This summary report discusses the ability of the transmission systems to handle firm and non-firm transactions, and whether such transactions would be impacted by a firm sale of 805 MW at the Canada/US border from Site C.

2. Physical Facilities

Task Group #3, which has been investigating PNW transmission capability, has estimated that the Canada/US Intertie and the 1994 US PNW system, as planned, will be capable of delivering 1200 MW firm/2000 MW non-firm from the Canada/US border. Expenditures of approximately $15M (1986 US) will be required to upgrade the US system to enable delivery of 2000 MW firm/3000 MW non-firm from the Canada/US border.

On the Canadian side, a number of transmission system additions will be required prior to the Site C development, to maintain firm supply to BCH's domestic loads plus the committed firm supply to Seattle City Light (SCL).

If the firm sale of Site C proceeds there would be a required firm transfer capability on the Canada/US Intertie of 805 MW plus an additional 250 MW under the long term agreement with SCL. Therefore, on the US side the 1200 MW firm transfer capability of the 1994 US PNW system is adequate to provide for the 1055 MW required for firm Site C and SCL deliveries. On the Canadian side, additional transmission reinforcements will be required to increase the firm capability deliverable to the border to 1055 MW required for firm Site C and SCL deliveries.

3. Current Use of the Canada/US Intertie

Data on current uses of the Intertie (defined by BPA as the Northern Intertie) has been divided into four categories. A summary of hourly transactions provided by BPA from 1 January 1983 to 30 September 1986 is attached. Definitions of the four categories of power transactions are also attached and described below.

Category 1 consists of firm deliveries across the Northern Intertie which occur year-round and are substantially Treaty driven transactions augmented with loss commitments and firm deliveries to NW parties (e.g. WWP). The tie has been loaded on average with amounts under 100 MW of this type of energy. At times this use has consumed up to 280 MW of line capacity. The firm contract between BCH and SCL for Skagit replacement has a demand of 250 MW.

Category 2 represents BPA uses of the Intertie which occur much of the year as BPA seeks to coordinate storage and system operation to the maximum. In past springs and summers large transfers have occurred in both directions frequently exceeding 500 MW on average in one direction or the other. Usually these are offset by returns in the same or in a subsequent month.

Category 3 transactions, which are short term sales, historically have approached 1000-1500 average MW. Extremes of nearly 3000 MW N-S have occurred (which would have been offset by S-N schedules such that the net schedule N-S would not have exceeded 2000 MW).

Category 4 transactions typically involve storage for BPA in the late spring and early summer runoff periods. These transactions can reach 2000 MW S-N during the Water Budget operation on the Columbia River during the months from mid-April to mid-June.

4. BCH Transmission System

At present there is transmission capability, except at the time of BCH's peak loads, to provide surplus non firm power from BCH's generating system to the Canada/US Intertie. Any reinforcements that are added to the transmission system to increase the firm capability to meet committed firm loads, will inherently provide some off-peak capability to provide for additional non firm deliveries. For example, in the mid-1990's BCH's peak load in the Lower Mainland is forecast to be about 5500 MW, but a load of 4000 MW would be exceeded only about 20% of the time. Therefore, 80% of the time 1500 MW of additional transmission capability would be available, subject to plant and line maintenance requirements, for BCH-PNW transactions on the Canada/US Intertie. No further off-peak capability would be planned unless it can be shown that additional facilities can be economically justified to meet demands for secondary energy deliveries and storage and coordination transfers between BCH and PNW systems.

5. Future Use of the Canada/US Intertie

BCH desires access to possible markets in California and the PNW and will require Intertie space on an ongoing basis. The Intertie also provides BPA major storage advantages and future loading of the tie for other purposes can be expected to reduce BPA's flexibility and ability to optimize system operation.

The long term objective of both BCH and PNW utilities should be to jointly utilize the storage capabilities of the existing projects to better position the hydroelectric resources of the entire region to access markets. Through time this could result in higher utilization of the Intertie for coordinated operations.

However, other considerations may affect the marketing of surplus power in the 1990's. One major impact would be the return to Canada of the downstream power benefits under the Columbia River Treaty. The capacity benefits are presently estimated to be about 1100 MW by the year 2003. Return of these benefits to Canada could completely unload the Canada/US Intertie during peak load periods if there is a large use of the Intertie for sale of power from Site C.

6. Conclusions

(i) The firm export sale of Site C would not impact on firm transactions on the Canada/US Intertie by the mid-1990's because BCH's planning of its transmission system would be designed to serve the needs of domestic customers in B. C. plus any firm export commitments.

(ii) In the future, further storage and coordination transactions between BCH and the PNW systems will add value and flexibility for the two systems. If Site C is constructed and power is exported to the US and if storage and coordination transfers between BCH and PNW systems increase by the mid-1990's such that a bottleneck on the Canada/US Intertie limits such transactions, an increase in the transfer capability of the Intertie on both sides of the border should be explored in relation to the benefits to be gained.

Attachments

6 January 1987

SUMMARY OF HOURLY TRANSACTIONS

1 January 1983 - 30 September 1986

- Hourly data representing the net of all schedules indicates that 33.4 percent of all hours from 1 January 1983 through 30 September 1986 were scheduled at a level greater than 1000 MW from N-S.

- The same hourly data shows 36.1 percent of all hours had total schedules from N-S greater than 1000 MW.

- The period evaluated includes both years that were subject to BPA's IAP and those that were prior to its implementation. Extremes of large surplus and balanced conditions, as well as various operating and marketing strategies are represented for BCH's exports.

- Approximately 4.5 percent of net schedules other than sales or transfers from Canada (Categories 1, 2 and 4) exceeded 1000 MW in the N-S direction. About 3 percent of total schedules in the N-S direction in these categories exceeded 1000 MW.

- The maximum total schedule in the N-S direction was 4050 MW, while 2250 MW was the greatest value scheduled from S-N.

- No outages or limitations on the interconnection capacity were considered in assessing impacts of additional firm schedules. When all Canada sales are excluded, only a small percentage (4.5 percent) of operational transactions would be impacted by a 1000 MW firm schedule at full interconnection capacity. However, these transactions would be the first to be excluded and are extremely valuable to the system's flexibility. As the PNW-SW Intertie is expanded, more of these types of transactions may be necessary.

CATEGORIES OF POWER TRANSACTIONS ON CANADA/US INTERTIE

1. Firm Deliveries North to South Including:

   - Canadian Entitlement
   - Canadian Wheeling
   - Deliveries for Losses
   - Washington Water Power Contract
   - Inactive Storage
   - BC-LA Settlement Energy
   - Seattle City Light, Encroachment
   - Cominco Shaping
   - Emergency Capacity

2. BPA Priority Nonfirm Transactions Including:

   - Operating Reserves
   - Active Storage/Protected Storage
   - Nonfirm Purchases

3. Non-BPA Short-Term Transactions Including:

   - Bilateral SW Sales
   - Bilateral NW Transfers
   - Alternative Fuel Loads

4. BPA Low Priority Transactions Including:

   - Nonfirm Purchases
   - Imminent Spill
   - Special Load Factoring
   - Storage Return

19 November 1986

APPENDIX C

SITE C STUDY: LEGAL WORKING GROUP

REPORT TO EXECUTIVE COMMITTEE

(24 SEPTEMBER 1986 MEETING)

The first two meetings of the Legal Working Group were held in Vancouver, B.C., on 12 August 1986 and in Seattle, Washington, on 16 September 1986.

Matters addressed at the two meetings are summarized as follows:

1. Site C Regulatory Aspects - B.C. and Canada

B.C. Hydro, provided information on the regulatory processes required in B.C. and in Canada and the anticipated time range for obtaining those approvals.

The major regulatory approvals required are:

B.C. - Energy Project and Operation Certificates under the B.C. Utilities Commission Act.
B.C. - Energy Removal Certificate under the B.C. Utilities Commission Act.
Can. - Export Licence under the National Energy Board Act.

Application for the Energy Project and Energy Removal Certificates are made to the B.C. government which may either decide the issues directly or refer them (under either application or both) to the Utilities Commission for a hearing. A National Energy Board Export Licence is issued by the Board but requires the approval of the Canadian Government - in any event a hearing is required.

It can be seen from the chart that if a hearing is required before the Utilities Commission the total elapsed time for approvals would be some four years; alternatively, if no Utilities Commission hearing were required the total elapsed time could be as short as fifteen months.

While the chart indicates some flexibility in the time required for the National Energy Board process, the most probable time required from application to approval is a period of from nine to twelve months.

Although it will be necessary to have a sale-purchase contract in place prior to any National Energy Board hearing it would be appropriate for the implementation of such a contract to be made conditional upon the obtaining of any U.S. regulatory approvals required, i.e. it would not be necessary to have U.S. approvals in effect prior to

commencing a National Energy Board hearing process or even prior to issue of an Export Licence. The National Energy Board would expect all Provincial (B.C.) approvals to have been obtained prior to any National Energy Board hearing.

There is currently a maximum limit of 25 years for the term of any National Energy Board Export Licence, however, this limit is under review and will be examined among all other aspects of electrical energy exports at a National Energy Board "Inquiry on the Federal Regulation of Electricity Exports" with hearings to commence in late November 1986. Copies of the terms of reference for this Inquiry were provided to the Legal Working Group members.

The major tests which the National Energy Board has applied and is expected to apply to proposals for electrical energy exports are, in summary:

- That the energy is surplus to Canadian requirements.
- That the price will recover all costs in Canada.
- That the price be not less than to equivalent domestic (i.e. Canadian) customers.
- That the price be not materially less than the least cost alternative to the export customer(s).

The National Energy Board also uses the umbrella test -- that the proposed export be "in the public interest" -- to enquire into any other matters it sees as relevant. Recent hearings before the National Energy Board have, for example, included examinations of social costs and native peoples employment opportunities.

2. <u>BPA Issues</u>

(a) BPA advised that the schedule for completion of Long Term Intertie Access Policy had been 1 January 1987 and is now 15 February 1987. They outlined the following process:

(i) 5 Sept 86 draft EIS mailed to DOE

(ii) 17 - 24 Oct 86 BPA issue draft policy

(iii) 1 - 5 Dec 86 public meetings in San Francisco, Portland and Ashland.

(iv) 31 Dec 86 deadline for comments on draft

(v) 15 February 87 issue policy.

(b) Northwest Power Act Acquisition Procedures

If BPA is to acquire part of Site C it must follow what are known as the Section 6(c) procedures.

BPA is currently developing a policy to guide such acquisitions. Current schedule calls for NWPPC and BPA to release an issue paper the week of 22nd September 1986. A public hearing has been set for 17th September 1986 in Portland. It is estimated that acquisition procedures will be finalized by 31 October 1986. The time to comply with these procedures is unknown. Therefore it is unlikely that BPA will at an early date be able to contract to acquire Site C Power. However, they may be able to take an option for future power acquisition.

3. Third AC Intertie

Possibility that some utilities may not get certification from C.P.U.C. If some utilities do not get certification then it is necessary that the unsubscribed portions be taken up by other participants. This process may involve some delay in the planned start of January 1988. If full subscription does not occur then the Project could go on hold until the economics are more certain

In view of the critical importance of the 3rd intertie (BPA policy) the concensus was that it would be desirable to invite a representative of the North and South California MUD's to the Site C Study meetings.

4. Standard Offer No. 4 Decision

A recent decision of the CPUC sets out a process for resource acquisition. The effect of this decision on Site C Power is uncertain. Applications have been filed to exclude power contracts from the process or at least to have other NW sources bid, not only the QF's. The time required for re decision is uncertain.

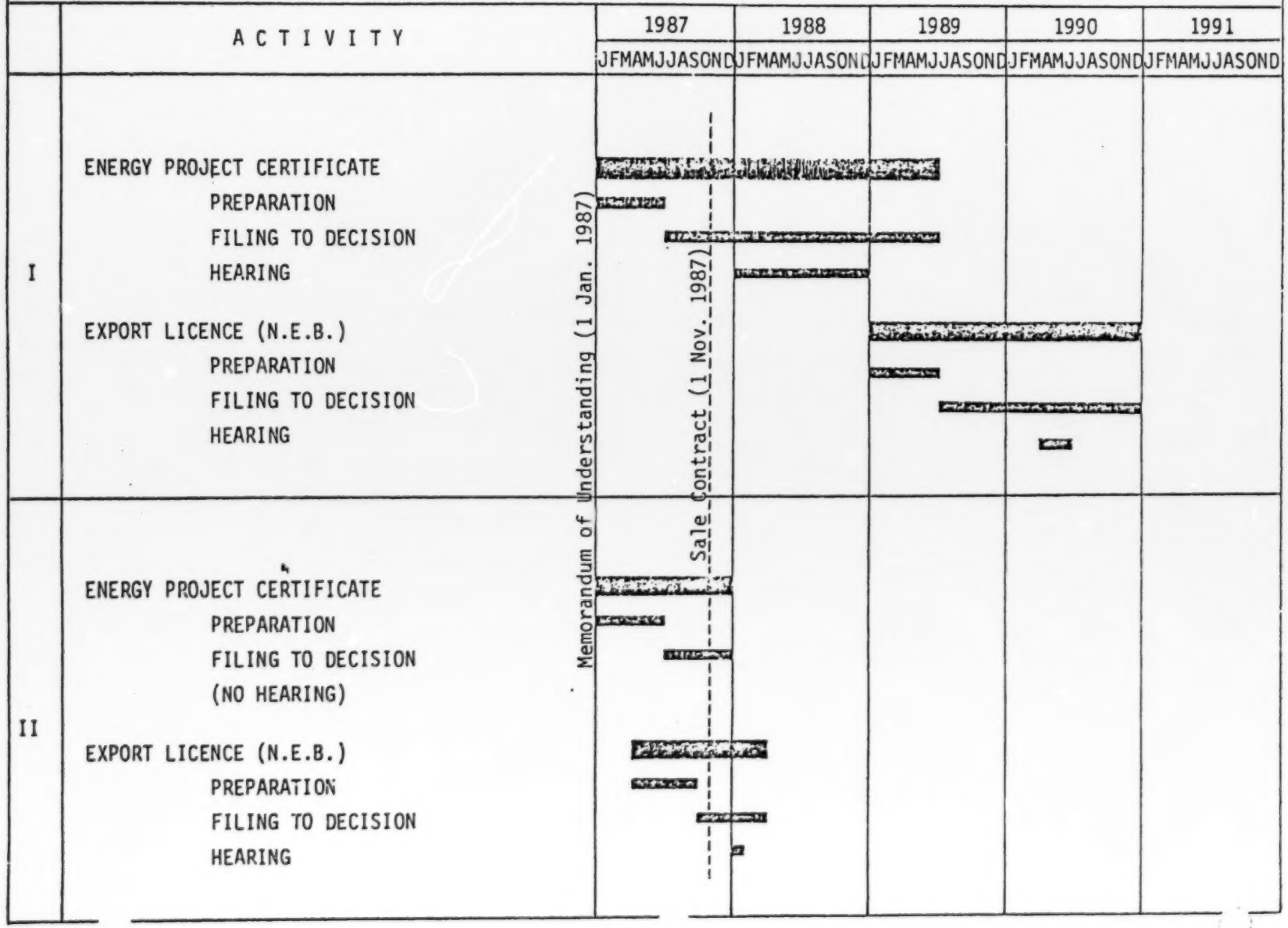
5. Contract or Treaty

Some U.S. Utilities noted that, particularly if financing was required from them, a Treaty may be necessary.

B.C.H.'s preference is for a Contract without the complications and time frame involved in negotiating a Treaty. It was noted that Eastern Canadian Utilities have contracted without a Treaty.

6. The Committee is proposing to meet again in Portland on 8 October 1986.

SITE C PROJECT
REGULATORY ASPECTS - B. C. AND CANADA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EXPORT LICENCE (N.E.B.)
PREPARATION
FILING TO DECISION
HEARING
Memorandum of Understanding (1 Jan. 1987)
Sale Contract (1 Nov. 1987)